BEST AVAILABLE RETROFIT TECHNOLOGY APPLICABILITY ANALYSIS
HONEYWELL INTERNATIONAL, INC. ▪ HOPEWELL PLANT

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1. INTRODUCTION

Honeywell International, Inc. (Honeywell) operates a chemical manufacturing plant in Hopewell, Virginia. The Hopewell Plant is a major source of air emissions and submitted a Title V application on June 30, 1998, and is expected to receive a final Title V permit in the coming months. Currently, Honeywell is operating under air permit registration number 50232, issued by the Virginia Department of Environmental Quality (DEQ). The facility is considered eligible to be regulated under the Best Available Retrofit Technology (BART) provisions of the Regional Haze Rule. This BART Applicability Analysis Report summarizes Honeywell's determination that the Hopewell Plant is not subject to BART because the air quality modeling analyses described in this report demonstrate that the facility does not contribute to visibility impairment at any federally protected Class I areas.

Honeywell submitted an initial source-specific BART Applicability Modeling Protocol on April 13, 2006, and subsequently received comments from Virginia DEQ on July 10, 2006. Honeywell provided a response to comments on July 31, 2006, and subsequent information on September 7, 2006 in response to a Virginia DEQ request for additional information on August 23, 2006. As described in Honeywell's responses to comments, Virginia DEQ's comments were reviewed and generally adhered to as described in this BART Applicability Analysis Report. In addition to these comments on the source-specific modeling protocol for the Hopewell Plant, Honeywell's evaluation of BART-eligibility and the modeling methods used to determine applicability of BART as described in this report are consistent with the following guidance documents:

- U.S. EPA, "Regional Haze Regulations and Guideline for Best Available Retrofit Technology (BART) Determinations," *Federal Register* Volume 70, Number 128, July 6, 2005.
- U.S. EPA, *Guidance for Tracking Progress under the Regional Haze Rule* (EPA-454/B-03-004), September 2003.
- U.S. EPA, *Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule* (EPA-454/B-03-005), October 2003.
- U.S. EPA, *Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report* (EPA-454/R-98-019), December 1998.
- U.S. EPA, *Guideline on Air Quality Models*, 40 CFR Part 51, Appendix W (Revised, November 9, 2005).
- VISTAS, *Protocol for the Application of the CALPUFF Model for Analyses of Best Available Retrofit Technology (BART), Revision 3.2*, August 31, 2006.
- VISTAS and U.S. EPA, "Q&A for Source by Source BART Rule" (Draft), October 28, 2005.
- Virginia DEQ, electronic communication to BART-eligible sources, multiple dates.

The *VISTAS BART Modeling Protocol* as revised on August 31, 2006, is incorporated by reference for Honeywell's source-specific modeling analyses. The *VISTAS BART Modeling Protocol* and related information (generally made available at the VISTAS BART website[1]) established common technical approaches for quantifying emissions from BART-eligible emission units and conducting screening

[1] http://vistas-sesarm.org/BART/index.asp

and refined modeling analyses using the CALPUFF modeling system and common data resources. Honeywell's analyses generally adhere to the recommendations made in the *VISTAS BART Modeling Protocol* as described in this report and adapted per Virginia DEQ guidance to the source-specific analysis of visibility impacts attributable to the Hopewell Plant.

1.1 OVERVIEW OF REGIONAL HAZE RULE AND BART REQUIREMENTS

The Regional Haze Rule requires that major sources of visibility-affecting pollutants belonging to one or more of 26 specific industrial source categories evaluate BART if the source was "in existence" (i.e., built or reconstructed) before August 7, 1977 and began operation after August 7, 1962. Such sources are termed "BART-eligible sources." Major sources of visibility-affecting pollutants have the potential to emit 250 tons per year (tpy) of one or more of oxides of nitrogen (NO_X), sulfur dioxide (SO_2), and particulate matter less than 10 micrometers in aerodynamic diameter (PM_{10}). Hereafter, the "BART-eligible source" is taken to mean the collection of sources at a facility in existence during the relevant time period within one or more BART source categories that has potential emissions of one or more visibility-affecting pollutants in excess of 250 tpy. The BART-eligible source may include multiple emission units, but need not include the entire facility.

1.1.1 DETERMINATION OF BART-ELIGIBILITY

The U.S. EPA BART guidelines define the following three steps for determining which sources at a facility are BART-eligible:

1. Identify the emission units in the BART source categories.
2. Identify the start-up dates of those units.
3. Compare potential emissions to the 250 tpy cutoff.

Chemical process plants are one of the listed source categories, and include chemical manufacturing operations that are considered to be part of major SIC code "28" – Chemicals and Allied Products. Honeywell and DEQ have determined that 21 emission units comprise the BART-eligible source because the units operate at a chemical plant, were in existence on August 7, 1977, and began operation after August 7, 1962. This collection of emission units has potential emissions of greater than 250 tpy of NO_X, SO_2, and ammonia (NH_3), which are visibility-affecting pollutants. Specific information about these emission units is provided in Section 2 of this BART Applicability Analysis Report. Note that industrial boilers greater than 250 million British thermal units per hour (MMBtu/hr) in heat input capacity are also considered a listed BART-eligible source category. However, the boiler at Honeywell's Hopewell Plant (Boiler #8) began operation prior to 1962. Therefore, the boiler is not part of the BART-eligible source and was not considered in this BART analysis.

1.1.2 ASSESSMENT OF CONTRIBUTION TO VISIBILITY IMPAIRMENT AND BART APPLICABILITY

In its role as technical analysis coordinator, VISTAS developed a common modeling protocol and data resources for use by state regulatory agencies and BART-eligible sources. The final *VISTAS BART Modeling Protocol* was issued on December 22, 2005,

was revised most recently on August 31, 2006, and prescribes modeling techniques and data resources to conduct screening and refined analyses to assess whether a BART-eligible source is subject to BART.

A BART-eligible source is determined to be subject to BART if the source causes or contributes to visibility impairment at a federally protected Class I area. Causation is defined as a single-source impact of 1.0 deciviews (dv) or more and contribution is defined as a single-source impact of 0.5 dv or more, each evaluated on a 24-hour average basis. The deciview is a metric used to represent normalized light extinction attributable to visibility-affecting pollutants. To determine whether a BART-eligible facility causes or contributes to visibility impairment, U.S. EPA guidance requires the use of an air quality model, specifically recommending the CALPUFF modeling system, to quantify the impacts attributable to a single BART-eligible source. Because contribution to visibility impairment is sufficient cause to require a BART determination, 0.5 dv is the critical threshold for assessment of BART applicability.

Regional haze is quantified using the light extinction coefficient (b_{ext}), which is expressed in terms of the haze index expressed in dv. The haze index (*HI*) is calculated as shown in the following equation.

$$HI = 10\ln\left(\frac{b_{ext}}{10}\right)$$

The impact of a BART-eligible source is determined by comparing the *HI* attributable to a source relative to estimated natural background conditions. The background extinction coefficient $b_{ext,\,background}$ is affected by various chemical species and the Rayleigh scattering phenomenon and can be calculated as shown in the following equation.

$$b_{ext,background}\left(\mathrm{Mm}^{-1}\right) = b_{SO_4} + b_{NO_3} + b_{OC} + b_{Soil} + b_{Coarse} + b_{ap} + b_{Ray}$$

where,

$b_{SO_4} = 3\left[(\mathrm{NH_4})_2\mathrm{SO_4}\right]f(RH)$ — $\left[(\mathrm{NH_4})_2\mathrm{SO_4}\right]$ denotes the ammonium sulfate concentration

$b_{NO_3} = 3\left[\mathrm{NH_4NO_3}\right]f(RH)$ — $\left[\mathrm{NH_4NO_3}\right]$ denotes the ammonium nitrate concentration

$b_{OC} = 4[\mathrm{OC}]$ — $[\mathrm{OC}]$ denotes the concentration of organic carbon

$b_{Soil} = 1[\mathrm{Soil}]$ — $[\mathrm{Soil}]$ denotes the concentration of fine soils

$b_{Coarse} = 0.6[\mathrm{Coarse\ Mass}]$ — $[\mathrm{Coarse\ Mass}]$ denotes the concentration of coarse dusts

$b_{ap} = 10[\mathrm{EC}]$ — $[\mathrm{EC}]$ denotes the concentration of elemental carbon

$b_{Ray} = \mathrm{Rayleigh\ Scattering}\left(10\ \mathrm{Mm}^{-1}\ \mathrm{by\ default}\right)$ — Rayleigh Scattering is scattering due to air molecules

$f(RH) = \mathrm{Relative\ Humidity\ Function}$

$[\ ] = \mathrm{Concentration\ in}\ \mu\mathrm{g/m}^3$

Values for the parameters listed above specific to the natural background conditions at the Class I areas considered in this analysis are provided on an annual average basis in the U.S. EPA's *Guidance for Estimating Natural Visibility Conditions under the Regional*

Haze Rule.[2] More detailed information about the natural background conditions particular to Class I areas potentially affected by Honeywell's Hopewell Plant are provided in Section 3.5 of this report.

Particulate species that affect visibility are emitted from anthropogenic sources and include coarse particulate matter (PMC), fine particulate matter (PMF), and elemental carbon (EC), as well as precursors to secondary organic aerosols (SOA) and fine particulate matter such as SO_2 and NO_X. The extinction coefficient due to emissions of visibility-affecting pollutants from a single BART-eligible source $b_{ext,source}$ is calculated using an air quality model. The extinction due to the BART-eligible source will be calculated as shown in the following equation.

$$b_{ext,source}\left(\mathrm{Mm}^{-1}\right) = b_{SO_4} + b_{NO_3} + b_{PMC} + b_{PMF} + b_{SOA} + b_{EC}$$

where,

$b_{SO_4} = 3\left[(\mathrm{NH_4})_2\mathrm{SO_4}\right] f(RH)$
$b_{NO_3} = 3\left[\mathrm{NH_4NO_3}\right] f(RH)$
$b_{SOA} = 4\left[\mathrm{SOA}\right]$
$b_{PMF} = 1\left[\mathrm{PMF}\right]$
$b_{PMC} = 0.6\left[\mathrm{PMC}\right]$
$b_{EC} = 10\left[\mathrm{EC}\right]$
$f(RH)$ = Relative Humidity Function
$[\ ]$ = Concentration in $\mu g/m^3$

$\left[(\mathrm{NH_4})_2\mathrm{SO_4}\right]$ denotes the ammonium sulfate concentration
$\left[\mathrm{NH_4NO_3}\right]$ denotes the ammonium nitrate concentration
$\left[\mathrm{SOA}\right]$ denotes the concentration of secondary organic aerosols
$\left[\mathrm{PMF}\right]$ denotes the concentration of fine PM
$\left[\mathrm{PMC}\right]$ denotes the concentration of coarse PM
$\left[\mathrm{EC}\right]$ denotes the concentration of elemental carbon

1.1.3 POTENTIALLY AFFECTED CLASS I AREAS

Honeywell used screening and refined modeling techniques as described in the *VISTAS BART Modeling Protocol* to determine whether BART-eligible operations at the Hopewell Plant contribute to visibility impairment at any Class I areas. The *VISTAS BART Modeling Protocol* specifies that all Class I areas within 300 km of a BART-eligible source must be evaluated to determine whether the source contributes to visibility impairment. Table 1-1 summarizes the distances separating Honeywell's Hopewell Plant from all Class I areas within the VISTAS region and adjacent states. Consistent with the *VISTAS BART Modeling Protocol*, only those Class I areas within 300 km were considered further in the BART applicability modeling analysis.

[2] U.S. EPA, *Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule*, Table 2-1, Attachment A, September 2003, EPA-454/B-03-005.

TABLE 1-1. DISTANCES (KILOMETERS) SEPARATING CLASS I AREAS AND HONEYWELL'S HOPEWELL PLANT

Class I Area	Distance (km)
Breton (LA/MS)	1,340
Cape Romain (SC)	503
Chassahowitzka (FL)	1,073
Cohutta (GA)	694
Dolly Sods (WV)	**258**
Everglades (FL)	1,326
Great Smoky Mountains (NC/TN)	546
Hercules Glade (MO)	1,379
James River Face (VA)	**190**
Joyce Kilmer/Slickrock (NC)	630
Linville Gorge (NC)	437
Mammoth Cave (KY)	770
Mingo (MO)	1,137
Okefenokee (GA)	831
Otter Creek (WV)	**275**
Shenandoah (VA)	**158**
Shining Rock (NC)	537
Sipsey (AL)	963
St. Marks (FL)	1,008
Swanquarter (NC)	**227**
Wolf Island (GA)	755

Figure 1-1 illustrates the location of the Hopewell Plant, and Figure 1-2 illustrates the location of the Hopewell Plant relative to the following five federally protected Class I areas that are located within 300 km of Honeywell's Hopewell Plant. Only these five areas were evaluated in the BART Applicability Analyses.

- Shenandoah National Park (NP), located approximately 158 km to the northwest of the facility, along the Blue Ridge Mountains in northwestern Virginia
- James River Face Wilderness Area (WA), located approximately 190 km to the west of the facility in central Virginia
- Swanquarter National Wildlife Refuge (NWR), located approximately 227 km to the south of the facility, along the Atlantic Coast in eastern North Carolina
- Dolly Sods WA, located approximately 258 km to the northwest of the facility in east central West Virginia
- Otter Creek WA, located approximately 275 km to the northwest of the facility in east central West Virginia

FIGURE 1-1. LOCATION OF HONEYWELL'S HOPEWELL PLANT

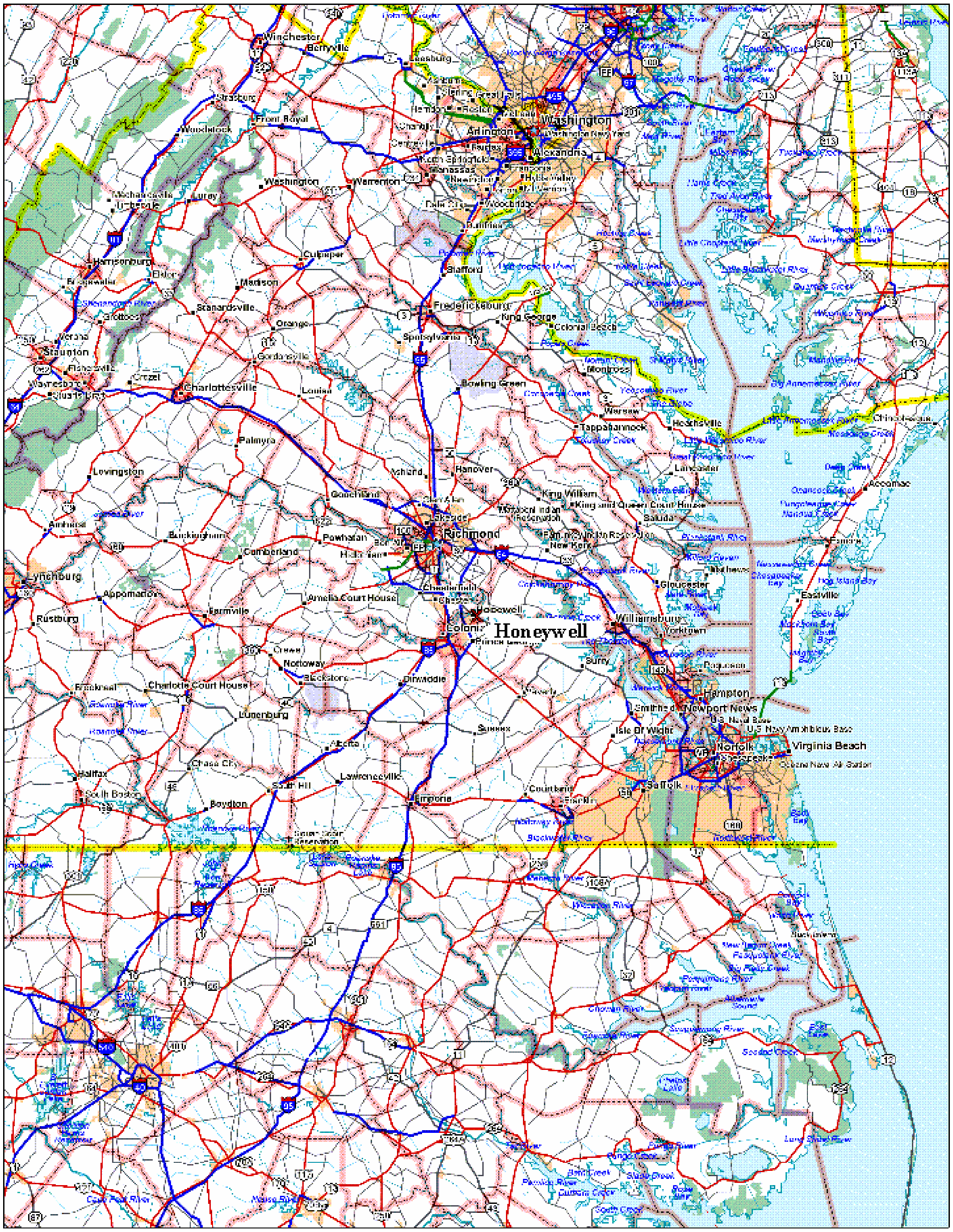
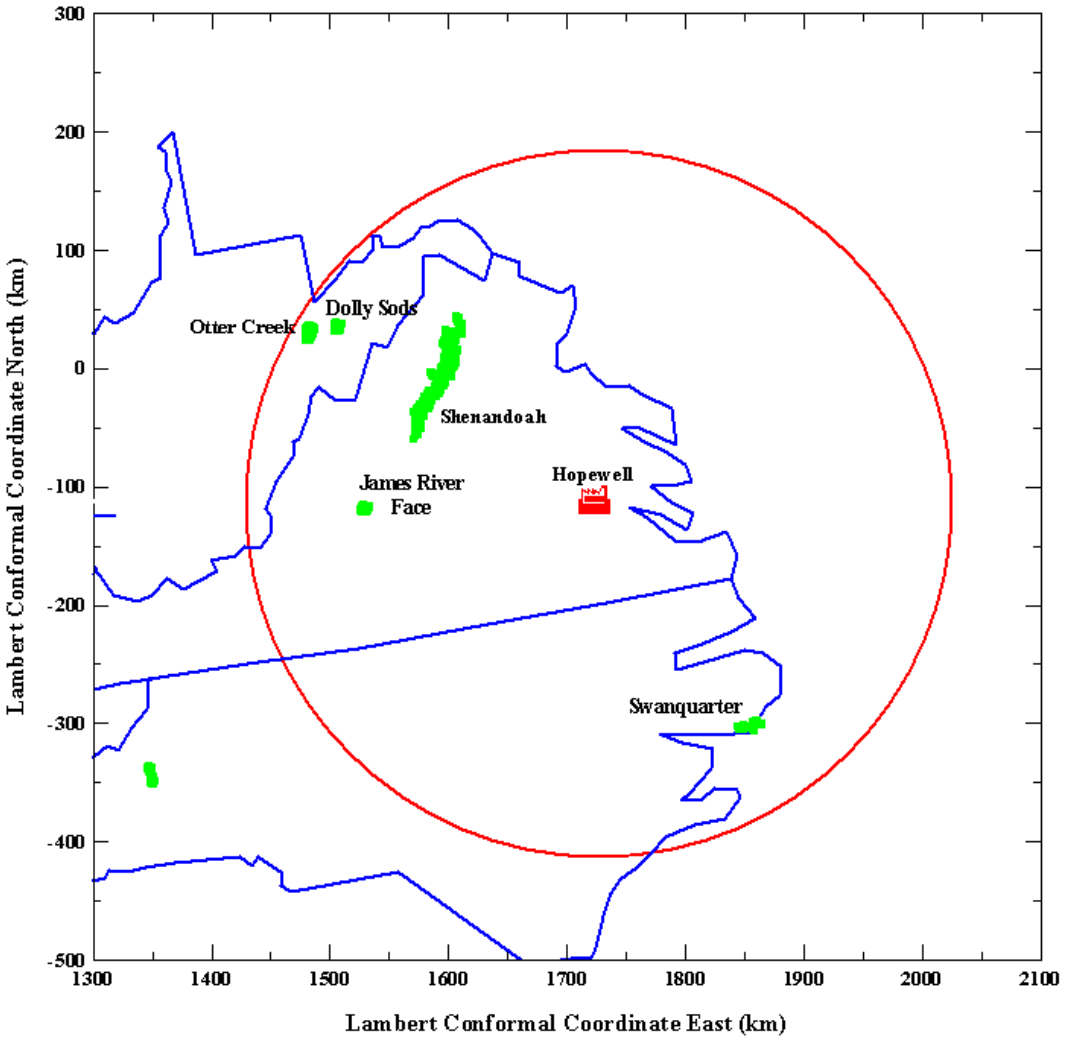


FIGURE 1-2. LOCATION OF HONEYWELL'S HOPEWELL PLANT RELATIVE TO CLASS I AREAS WITHIN 300 KM



1.1.4 CALPUFF MODELING ANALYSES

As recommended by the U.S. EPA BART guidelines and *VISTAS BART Modeling Protocol*, the CALPUFF modeling system was used to compute the 24-hour average visibility impairment attributable to Honeywell's Hopewell Plant to assess whether the 0.5 dv contribution threshold is exceeded, and if so, the frequency, duration, and magnitude of any exceedance events. CALPUFF is a refined air quality modeling system that is capable of simulating the dispersion, chemical transformation, and long-range transport of multiple visibility-affecting pollutant emissions from a single source and is therefore preferred for BART applicability and determination analyses. The CALPUFF modeling system is described in technical detail in the *VISTAS BART Modeling Protocol* as revised and its use in screening and refined analyses for BART applicability assessment of Honeywell's Hopewell Plant was described in Sections 3, 4, and 5 of the source-specific modeling protocol.

1.2 ORGANIZATION OF BART APPLICABILITY ANALYSIS REPORT

The remainder of this BART Applicability Analysis report is organized as follows.

- Section 2 describes the BART-eligible emission units at the Hopewell Plant and the emission rates modeled in the BART Applicability Analysis.
- Section 3 describes the procedural and technical guidance for conducting Class I area analyses using the CALPUFF modeling system, including the data resources, technical modeling options, and quality assurance methods used in the CALMET, CALPUFF, and CALPOST analyses.
- Section 4 describes the results of the screening modeling analyses.
- Section 5 describes the results of the refined modeling analyses.
- Section 6 presents a summary of the BART Applicability Analysis and the conclusion that the Hopewell Plant is not subject to BART.

Supplemental information is provided in several appendices to this report. Appendix A contains sample model and postprocessing input and output files used for Honeywell's analysis of the Hopewell Plant. Appendix B presents a comparative analysis demonstrating the explicit modeling approach used in CALPUFF. Electronic copies of model input and output files are provided on electronic media accompanying this BART Applicability Analysis Report, a file index for which is presented in Appendix C.

This section of the BART Applicability Analysis Report describes the emission units that comprise the BART-eligible source at Honeywell's Hopewell Plant. Emissions and exhaust characteristics of each emission unit are quantified to demonstrate how each unit was represented in the modeling analysis.

2.1 BART-ELIGIBLE EMISSION UNITS

Honeywell reviewed the criteria for BART-eligibility and determined that the 21 emission units described in Table 2-1 comprise the BART-eligible source at the Hopewell Plant based on the source category and date-in-existence eligibility criteria.

TABLE 2-1. SUMMARY OF BART-ELIGIBLE EMISSION UNITS

Emission Unit	Source Code/ Stack ID	BART Source Category†	Date‡ Built or Modified	Potential SO_2 Emissions (tpy)	Potential NO_X Emissions (tpy)	Potential PM_{10} Emissions (tpy)	Potential NH_3 Emissions (tpy)	Potential VOC Emissions (tpy)
FU-1 Kellogg Reformer	11A/103	21, 22	1960's	11	553	46	9.7	5.2
FU-6 Girdler	12A/106	21	1960's	--	81	4.9	1.3	1.0
FU-14 Hazardous Waste Incinerator	42A/405	21	1970's	43.8	87.1	3.2	0.35	0.35
Ammonium Nitrite "C" Train	90C/902	21	1964	--	1,257	27.4	69.5	--
Ammonium Nitrite "D" Train	90D/903	21	1966	--	600	6.0	561	--
Ammonium Nitrite "E" Train	90E/904	21	1974	--	600	6.0	432	--
Hydroxylamine Disulfonate "C" Train	91C/907	21	1964	7.0	1,155	4.5	338	--
Hydroxylamine Disulfonate "D" Train	91D/908	21	1966	7.0	600	4.5	376	--
Hydoxylamine Disulfonate "E" Train	91E/909	21	1974	8.3	600	4.5	186	--
Sulfuric Acid Plant	14A/108	21	1965	200	--	8.2	--	--
FU-5 Kellogg Startup Heater‡	11D/109	21	1960's	--	3	46	--	15.5
MDEA Storage	13A/107	21	1970's	--	--	--	--	6.0
VT-418 CO2 Stripper	11B/106	21	1965	--	--	--	--	7.3
HT-241 MeOH Breathing	11C/105	21	1970's	--	--	--	--	3.3
Kellogg Startup Desulfur	16D/118	21	1965	--	--	--	--	1.73
Area 14 Storage	40A/400	21	1965	--	--	--	--	--
CL-16 Sulfate Stripping Column	40B/401	21	1966	--	--	--	--	0.64
CL23/24 MEKO Lites Distillation	40C/404	21	1966	--	--	--	--	5.1
VT-853 Reactor Loop	40D/403	21	1974	--	--	--	--	--
A14 Loading	40E/405	21	1974	--	--	--	--	--
Area 14 /PC VOC Equipment Leaks	49Z/407	21	1965	--	--	--	--	200
Total Potential Emissions (tpy)				**277.1**	**5,536.1**	**161.2**	**1,973.9**	**246.1**

† Category 21 denotes chemical process plants; category 22 denotes large fossil fuel boilers, which for the purposes of BART eligibility include boilers individually greater than 250 MMBtu/hr that burn any amount of fossil fuel.

‡ The Kellogg Startup Heater is included for BART eligibility but excluded from the Applicability Analysis since the BART guidelines specifically exclude emission units associated with startup, shutdown, or malfunction.

Honeywell's Hopewell Plant is BART-eligible since potential emissions exceed 250 tpy for at least one of NO_X, SO_2, $PM_{10,}$ and NH_3, which are considered visibility-affecting pollutants. Note that many of the otherwise BART-eligible emission units have potential emissions only of volatile organic

compounds (VOC), which VISTAS and Virginia DEQ have determined are not visibility-affecting pollutants for the purposes of BART Applicability Analyses. Section 4.1.3 of the *VISTAS BART Modeling Protocol* describes the regional modeling analyses showing that cumulative VOC emissions do not contribute to visibility impairment within the VISTAS region:

> *VOC emissions from all anthropogenic point sources in every VISTAS State were reduced by 100% (i.e., eliminated). The maximum 24-hr impact of all VOC emissions from all point sources throughout the VISTAS domain was thus determined to be less than 0.5 dv (compared to annual average natural background) at every Class I area in the VISTAS domain and in adjacent States. It follows that the impact of any one BART-eligible source would be much less than 0.5 dv. Based on these analyses, the VISTAS States have concluded that VOC emissions from BART sources do not cause or contribute to visibility impairment and do not need to be included in BART analyses.*

VISTAS also conducted analyses to determine whether NH_3 emissions should be considered visibility-affecting for the purposes of source-specific BART applicability analyses. Section 4.1.3 of the *VISTAS BART Modeling Protocol* indicates that the U.S. EPA BART guidelines give states the option to address NH_3 emissions from BART-eligible sources. A summary presentation made available by the VISTAS Technical Analysis Workgroup on May 3, 2006 concludes that NH_3 emissions from BART sources in the VISTAS region may affect visibility, and that states may request that thirteen large sources of NH_3 include primary NH_3 emissions in the BART applicability modeling analyses and assess NH_3 emissions controls. Because of the magnitude of NH_3 emissions from Honeywell's Hopewell Plant, Virginia DEQ specifically requested that primary NH_3 emissions be modeled in Honeywell's BART applicability analyses.

As a result of these determinations, Honeywell did not model VOC emissions from the BART-eligible source but did model primary emissions of NH_3. The following section of this report describes the methodology and resources used to quantify modeled emission rates.

2.2 BART-ELIGIBLE SOURCE MODEL EMISSIONS INVENTORY

Whereas the BART eligibility determination relies on potential emissions of visibility-affecting pollutants, the BART applicability modeling analysis utilizes maximum actual 24-hour average emission rates of NO_X, SO_2, PM_{10}, and NH_3. The *VISTAS BART Modeling Protocol* specifies the following hierarchy of information resources to establish the maximum actual 24-hour average emission rate for BART applicability modeling over the prior three-to-five year period:

- 24-hour maximum emissions observed using a Continuous Emission Monitor (CEM) for the period 2001 through 2003
- 24-hour maximum emissions observed using a CEM for any representative period
- Facility stack test emissions
- Potential to emit
- Permit allowable emissions
- Emissions factors from U.S. EPA *AP-42* source profiles

Because VOC is not considered a visibility-affecting pollutant included in source-specific BART modeling analyses, ten of the otherwise BART-eligible emission units at the Hopewell Plant were excluded from further evaluation since these units do not emit other visibility-affecting pollutants (i.e., NO_X, SO_2, PM_{10}, or NH_3). Additionally, the Kellogg Startup Heater source was excluded from further analyses since the U.S. EPA's and VISTAS BART guidelines specifically exclude emission units associated with startup, shutdown, or malfunction events. The remaining 10 emission units were modeled in Honeywell's BART Applicability Analyses. Honeywell's responses to comments following submittal of the initial BART modeling protocol focused on the quantification of maximum actual 24-hour average emissions for the purposes of BART applicability assessment.

Honeywell primarily used historical operating data to determine the maximum actual 24-hour average emission rates for modeling analyses. Historical operating data are unavailable only for the waste incinerator, for which source permitted emission limits were used. Honeywell calculates and tracks emission rates of visibility-affecting pollutants on an hourly basis in an electronic environmental management information system (referred to as the CIRRUS system). Emission rates calculated within the CIRRUS system are based on process parameters and stack test results. Specifically with regard to NH_3 emissions from the nitrite and disulfonate trains, NH_3 emissions are calculated from process parameters such as temperature, pressure, and throughput. For the Kellog and Girdler units, NH_3 emissions were based on maximum heat input for each unit (MMBtu/hr) and an NH_3 emission factor (3.2 lb/million standard cubic feet) from U.S. EPA's FIRE (version 6.25) emission factor database.

Honeywell examined the historical data contained in the system for the specific period beginning in 2001 through December 31, 2005, during which time historical operating records are generally available. The BART modeling emissions inventory derived from historical operating data at the Hopewell Plant represent the maximum 24-hour emission rate from this period. Therefore, the proposed emissions data represent the most recent three- to five-year period, as recommended by Virginia DEQ. Table 2-2 summarizes the maximum 24-hour actual emission rate of each visibility pollutant from each BART-eligible unit with emissions of visibility affecting pollutants and an indication of the data source of the maximum actual emission rate.

TABLE 2-2. SUMMARY OF 24-HOUR AVERAGE MAXIMUM ACTUAL EMISSION RATES

Emission Unit	NO_X Emissions (lb/hr)	SO_2 Emissions (lb/hr)	Total PM_{10} Emissions (lb/hr)	Total $PM_{2.5}$ Emissions (lb/hr)	H_2SO_4 Emissions (lb/hr)	NH_3 Emissions (lb/hr)	Data Source
FU-1 Kellogg Reformer	137.92	1.17	10.00	10.00	--	2.22	CIRRUS
FU-6 Girdler	17.17	0.08	0.92	0.92	--	0.29	CIRRUS
FU-14 Hazardous Waste Incinerator	25.00	10.00	0.88	0.78	0.15	--	Permit Limits
Ammonium Nitrite "C" Train	556.66	--	6.58	6.58	--	304.40	CIRRUS
Hydoxylamine Disulfonate "C" Train	261.00	0.17	1.08	1.08	--	217.90	CIRRUS
Ammonium Nitrite "D" Train	183.33	--	0.16	0.16	--	861.49	CIRRUS
Hydoxylamine Disulfonate "D" Train	235.00	0.17	0.92	0.92	--	118.01	CIRRUS
Ammonium Nitrite "E" Train	183.33	--	0.16	0.16	--	409.91	CIRRUS
Hydoxylamine Disulfonate "E" Train	182.50	0.42	0.83	0.83	--	124.83	CIRRUS
Sulfuric Acid Plant	--	46.57	0.50	0.50	0.50	--	CIRRUS

Modeling of visibility impairment requires that the components of the exhaust stream be speciated because different types of particulate matter affect visibility to varying extents. The amount by which a mass of a certain species scatters or absorbs light is termed the *extinction efficiency* or *extinction coefficient*, and ranges from values of 0.6 m^2/g for coarse particulate matter to 10 m^2/g for elemental carbon. Fine particulate matter (1 m^2/g) and organic aerosols (4 m^2/g) scatter light with intermediate efficiencies, and ammonium sulfate and ammonium nitrate (that forms from precursor SO_2 and NO_X emissions in the presence of ambient NH_3) are hygroscopic species that are particularly efficient light scatters in the presence of ambient water vapor ($3f$(RH) m^2/g, where f(RH) is a function of the relative humidity). The size distribution of particle species is also important, since smaller particles may be transported longer distances than larger particles and dispersed differently under prevailing ambient conditions. Figure 2-1 depicts the speciation of visibility-affecting pollutant emissions as represented in the *VISTAS BART Modeling Protocol*.

FIGURE 2-1. PARTICULATE MATTER SPECIATION (AFTER FIGURE 4-3 OF THE *VISTAS BART MODELING PROTOCOL*)

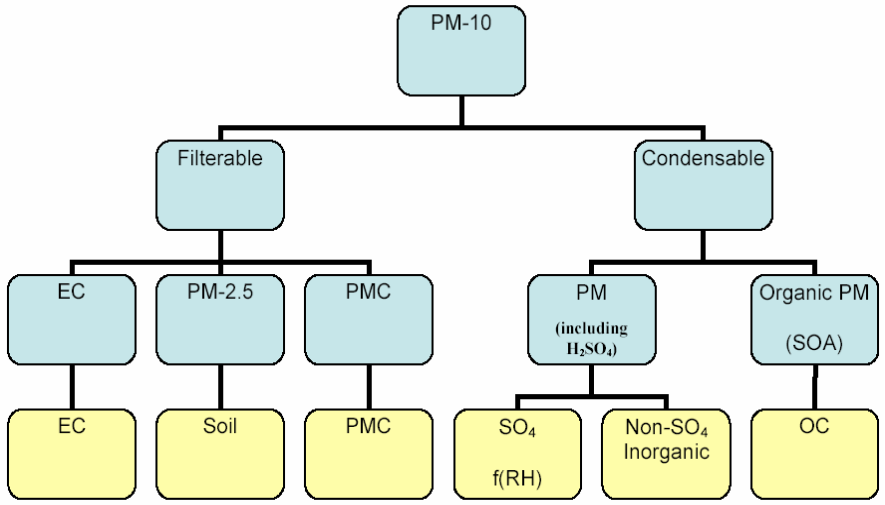


Table 2-3 gives defines the nomenclature used herein for speciated PM data.

TABLE 2-3. NOMENCLATURE FOR EMISSIONS SPECIATION ANALYSIS

Nomenclature	Description
TSP	Total suspended particulate, filterable PM with an aerodynamic diameter < 30 μm
PM_{10}	Filterable particulate matter with an aerodynamic diameter < 10 μm
$PM_{6\text{-}10}$	Filterable particulate matter with an aerodynamic diameter > 6 and < 10 μm
$PM_{2.5\text{-}6}$	Filterable particulate matter with an aerodynamic diameter > 2.5 and < 6 μm
$PM_{2.5}$	Filterable particulate matter with an aerodynamic diameter < 2.5 μm
$PM_{1.25\text{-}2.5}$	Filterable particulate matter with an aerodynamic diameter > 1.25 and < 2.5 μm
$PM_{1\text{-}1.25}$	Filterable particulate matter with an aerodynamic diameter > 1.0 and < 1.25 μm
$PM_{0.625\text{-}1}$	Filterable particulate matter with an aerodynamic diameter > 0.625 and < 1.0 μm
$PM_{0.5\text{-}0.625}$	Filterable particulate matter with an aerodynamic diameter > 0.5 and < 0.625 μm
EC	Elemental carbon
CPM	Condensable particulate matter (organic and inorganic)
POC	Primary organic condensable emissions
PIC	Primary inorganic condensable emissions (non-sulfate and non-nitrate)
SO4	Primary sulfate
NO3	Primary nitrate
TPM_{10}	Filterable PM_{10} + CPM
$TPM_{2.5}$	Filterable $PM_{2.5}$ + CPM

These PM classifications are necessary in the Class I visibility analysis because each type of PM has a different effect on visibility as defined by the extinction efficiency. The emission rates of each of these particulate phases and size categories are modeled in CALPUFF and grouped according to visibility affecting characteristics as was illustrated in Figure 2-1. Elemental carbon (EC) typically results from unburned carbonaceous fuel and is distinguished from other PM types because of its light extinction characteristics. Coarse PM (PMC) comprises $PM_{2.5\text{-}6}$ and $PM_{6\text{-}10}$. Fine PM (PMF) comprises $PM_{0.5\text{-}0.625}$, $PM_{0.625\text{-}1}$, $PM_{1\text{-}1.25}$, and $PM_{1.25\text{-}2.5}$. CPM comprises both organic and inorganic species. The organic fraction of CPM is represented in CALPUFF as primary organic condensable (POC) emissions, which are direct emissions but are sometimes referred to as secondary organic aerosols (SOA) by convention and due to the representation of their visibility-affecting characteristics in the light extinction equation.

Primary emissions of inorganic CPM (PIC) may contain hygroscopic sulfates (SO_4) and nitrates (NO_3), as well as other salts (e.g., carbonates) that may be hygroscopic to a lesser degree, and hence are considered in a manner similar to PMF (i.e., as soil) in terms of light extinction.[3] Therefore, it is important to distinguish inorganic CPM since hygroscopic species (i.e., sulfate and nitrate) will have a greater extinction coefficient than non-hygroscopic (i.e., non-sulfate and non-nitrate) species. Even the distinction between primary sulfate and nitrate emissions is important since primary nitrate emissions will be affected by the partitioning of nitrate and nitric acid in the presence of ambient NH_3, which is modeled explicitly in CALPUFF and is corrected when the ammonia limiting method

[3] The U.S. EPA's *Guidance for Tracking Progress under the Regional Haze Rule* identifies carbonates, magnesium oxides, and sodium oxides as components of the soil mass concentration when analyzed to assess natural background visibility (Malm 1994).

(as described in Section 3 of this report) is applied in the POSTUTIL postprocessing stage. Honeywell distinguishes primary emissions of sulfates and nitrates, which were assigned to the appropriate modeled PM type (i.e., SO4 and NO3, respectively), from non-hygroscopic species (e.g., carbonates), which were assigned to the PIC modeled species. Table 2-4 summarizes the grouping of PM species and extinction coefficient of each component.

TABLE 2-4. ASSIGNMENT OF EMITTED PM SPECIES TO MODELED PM CATEGORIES

Modeled PM Category[1]	Components	Output Category[2]	Extinction Coefficient (m^2/g)
PMC	Filterable coarse particles ($PM_{6\text{-}10}$, $PM_{2.5\text{-}6}$)	PMC	0.6
PMF	Filterable fine particles ($PM_{1.25\text{-}2.5}$, $PM_{1\text{-}1.25}$, $PM_{0.625\text{-}1}$, $PM_{0.5\text{-}0.625}$)	SOIL	1
PIC	Non-hygroscopic, primary inorganic condensable (PIC) emissions	SOIL	1
SO4	Primary inorganic condensable emissions of sulfates	SO4	3*f*(RH)
NO3	Primary inorganic condensable emissions of nitrates	NO3	3*f*(RH)
POC	Primary organic condensable emissions	SOA	4
EC	Uncombusted carbonaceous fuel	EC	10

[1] Modeled PM Category denotes the input of emissions data into CALPUFF.

[2] Output Category denotes the assignment of modeled emissions in POSTUTIL for the visibility calculations in CALPOST.

2.2.1 NATURAL GAS COMBUSTION UNITS PARTICULATE SPECIATION

Honeywell operates the natural gas-fired Kellogg reformer (Permit Emission Unit 11A) and Girdler Unit (Permit Emission Unit 12A) from which particulate emissions occur due to combustion of natural gas, a raw material in the process. To speciate the PM emissions from these gas-fired combustion sources, Honeywell utilized PM size fractions and CPM emissions information from Section 1.4 of U.S. EPA's *AP-42* emission factor database.[4] Honeywell also referred to the National Park Service (NPS) guidance for speciation of natural gas combustion sources, which initially suggested (as was represented in the initial source-specific modeling protocol) that all fine particulate matter should be considered elemental carbon.[5] This guidance was subsequently revised by the National Park Service to indicate that only 6.7% of the fine, filterable PM is EC.[6] Finally, a recent study for the National Petroleum Technology Office of the U.S. Department of Energy (DoE) was utilized to determine the organic and inorganic portions of CPM.[7] Table 2-5 summarizes the relevant data for this category of sources.

[4] AP-42, Section 1.4, *Natural Gas Combustion,* Table 1.4-2, July 1998.

[5] http://www2.nature.nps.gov/air/permits/emissions_ControlTech.cfm

[6] Electronic correspondence from Mr. Don Shepherd (NPS) to Mr. Michael Kiss (Virginia DEQ) dated May 5, 2006.

[7] England, Glenn. *Development of Fine Particulate Emission Factors and Speciation Profiles for Oil- and Gas-Fired Combustion Systems.* http://www.nyserda.org/programs/Environment/EMEP/project/6230/6230_pwp.asp.

TABLE 2-5. KELLOGG REFORMER/GIRDLER SPECIATION DATA

Speciation Data	Value	Reference
Organic portion of CPM	89.84%	U.S. DoE Study, Table 3-11
Inorganic portion of CPM	10.16%	
Filterable portion of TPM_{10}	25.0%	AP-42 Section 1.4, Table 1.4.2 Natural Gas Combustion
EC as a % of Filterable PM_{10}	6.7%	
Condensable portion of TPM_{10}	75.0%	
$PM_{6\text{-}10}$ as a % of PM_{10}*	0.0%	
$PM_{2.5\text{-}6}$ as a % of PM_{10}*	0.0%	
$PM_{1.25\text{-}2.5}$ as a % of PM_{10}*	0.0%	
$PM_{1\text{-}1.25}$ as a % of PM_{10}*	0.0%	
$PM_{0.625\text{-}1}$ as a % of PM_{10}†	15.0%	
$PM_{0.5\text{-}0.625}$ as a % of PM_{10}†	85.0%	

* AP-42 states that all PM (total, condensable, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, TPM_{10} is equivalently 400% of Filterable PM_{10}.

† AP-42 does not provide size speciation. However, the U.S. DOE study for site Delta indicates that 7% of filterable PM is greater than 0.625 microns and an additional 16% is between 0.32 and 1.0 microns. 7% plus 8% (half of the 16% attributed to the 0.32 to 1.0 size category in the study) is considered to be $PM_{0.625\text{-}1.0}$ for BART speciation purposes. The remaining filterable PM was attributed $PM_{0.5\text{-}0.625}$.

The AP-42 emission factors for natural gas combustion indicate that all PM emissions from natural gas combustion are less than 1 micrometer; therefore, there are no coarse PM (PMC) emissions from the Reformer and Girdler units. Fine, filterable PM emissions (PMF) modeled represent the balance of filterable PMF not allocated to EC. Condensable emissions are allocated between primary organic (POC) and inorganic species (PIC). Pipeline quality natural gas combustion results in little sulfur emissions due to negligible fuel sulfur content; therefore, all PIC emissions were represented as non-sulfate primary emissions.

Table 3-11 of the DoE report notes 61% of the total PM_{10} is organic carbon while 6.9% of the total PM_{10} is inorganic carbon. To determine the percentages of CPM that are organic and inorganic, the following calculations were utilized:

$$\text{Organic \% of CPM} = \frac{61\%}{61\% + 6.9\%} = 89.8\%$$

$$\text{Inorganic \% of CPM} = \frac{6.9\%}{61\% + 6.9\%} = 10.2\%$$

TPM_{10} and $TPM_{2.5}$ emissions, which are equivalent for natural gas combustion sources, were calculated based on the total (filterable plus condensable) emission factors, which represent TPM as 400% of the filterable fine $PM_{2.5}$ emissions for each source. For example, total PM_{10} ($PM_{2.5}$) emissions from the Reformer are 10.0 lb/hr; therefore, filterable PM_{10} and $PM_{2.5}$ emissions are calculated as 2.5 lb/hr.

Organic CPM emissions were determined by multiplying the calculated TPM_{10} emissions by the condensable percentage of TPM_{10} and the organic percentage of CPM. Organic CPM was assumed to be evenly split between the two size categories, 0.625-1.0 μm and

0.5-0.625 μm. An organic CPM calculation for the Reformer TPM_{10} emission rate of 40.0 lb/hr is shown below.

$$\left(10.0\frac{\text{lb TPM}_{10}}{\text{hr}}\right)\left(75\%\frac{\text{CPM}}{\text{TPM}_{10}}\right)\left(89.84\%\frac{\text{organic CPM}}{\text{CPM}}\right)/2 = 3.37\frac{\text{lb organic CPM for each size category}}{\text{hour}}$$

PIC emissions were calculated using a similar methodology, yielding 0.0762 lb/hr of sulfate for a 1 lb/hr source.

$$\left(10.0\frac{\text{lb TPM}_{10}}{\text{hr}}\right)\left(75\%\frac{\text{CPM}}{\text{TPM}_{10}}\right)\left(10.16\%\frac{\text{inorganic CPM}}{\text{CPM}}\right)/2 = 0.38\frac{\text{lb inorganic CPM for each size category}}{\text{hour}}$$

Filterable PM_{10} emissions were divided amongst six different size categories by multiplying TPM_{10} emissions by the filterable % and then by the % of PM_{10} for each size category, yielding hourly emissions of $PM_{6\text{-}10}$, $PM_{2.5\text{-}6}$, $PM_{1.25\text{-}2.5}$, $PM_{1\text{-}1.25}$, $PM_{0.625\text{-}1}$, and $PM_{0.5\text{-}0.625}$. For natural gas combustion, all mass is less than 1 micron, 15% of which is between 0.625 μm and 1.0 μm, and the remaining 85% between 0.5 μm and 0.625 μm. Note that 6.7% of filterable PM less than 2.5 microns in size was assumed to be elemental carbon per NPS guidance.

$$\left(10.0\frac{\text{lb TPM}_{10}}{\text{hr}}\right)\left(25\%\frac{\text{PM}_{10}}{\text{TPM}_{10}}\right)\left(15\%\frac{\text{PM}_{0.625\text{-}1.0}}{\text{PM}_{10}}\right)\left(6.7\%\frac{\text{EC}}{\text{Filterable PM}_{10}}\right) = 0.0251\frac{\text{lb EC}_{0.625\text{-}1.0}}{\text{hour}}$$

$$\left(10.0\frac{\text{lb TPM}_{10}}{\text{hr}}\right)\left(25\%\frac{\text{PM}_{10}}{\text{TPM}_{10}}\right)\left(15\%\frac{\text{PM}_{0.625\text{-}1.0}}{\text{PM}_{10}}\right) - 0.0251\frac{\text{lb EC}_{0.625\text{-}1.0}}{\text{hour}} = 0.350\frac{\text{lb PM}_{0.625\text{-}1.0}}{\text{hour}}$$

$$\left(10.0\frac{\text{lb TPM}_{10}}{\text{hr}}\right)\left(25\%\frac{\text{PM}_{10}}{\text{TPM}_{10}}\right)\left(85\%\frac{\text{PM}_{0.5\text{-}0.625}}{\text{PM}_{10}}\right)\left(6.7\%\frac{\text{EC}}{\text{Filterable PM}_{10}}\right) = 0.142\frac{\text{lb EC}_{0.5\text{-}0.625}}{\text{hour}}$$

$$\left(10.0\frac{\text{lb TPM}_{10}}{\text{hr}}\right)\left(25\%\frac{\text{PM}_{10}}{\text{TPM}_{10}}\right)\left(85\%\frac{\text{PM}_{0.5\text{-}0.625}}{\text{PM}_{10}}\right) - 0.142\frac{\text{lb EC}_{0.5\text{-}0.625}}{\text{hour}} = 1.98\frac{\text{lb PM}_{0.625\text{-}1.0}}{\text{hour}}$$

Similar calculations were made for the 0.92 total PM_{10} ($PM_{2.5}$) emission rate from the Girdler unit. Table 2-6 presents a summary of the speciated PM emissions for the Reformer and Girdler units. Figures 2-2 and 2-3, respectively, present graphical representations for the total 10.0 lb/hr of TPM_{10} from the reformer and 0.92 lb/hr of TPM_{10} from the girdler

TABLE 2-6. KELLOGG REFORMER/GIRDLER PM SPECIATED EMISSIONS (LB/HR)

Unit	POC (μm) 0.625-1.0	POC (μm) 0.5-0.625	PIC (non-sulfate) (μm) 0.625-1.0	PIC (non-sulfate) (μm) 0.5-0.625	SO_4	PMC (μm) 2.5-10	PMF (μm) 1.0-2.5	PMF (μm) 0.625-1.0	PMF (μm) 0.5-0.625	EC (μm) 0.625-1.0	EC (μm) 0.5-0.625
Reformer	3.37	3.37	0.38	0.38	--	--	--	0.35	1.98	0.025	0.14
Girdler	0.31	0.31	0.035	0.035	--	--	--	0.032	0.18	0.0023	0.013

FIGURE 2-2. KELLOGG REFORMER TPM_{10} SPECIATION (LB/HR)

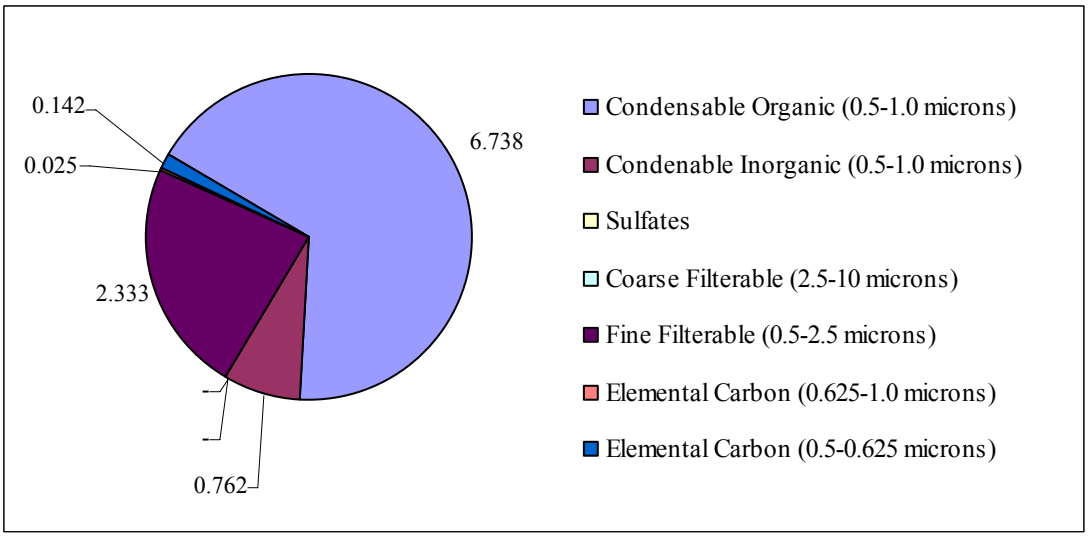
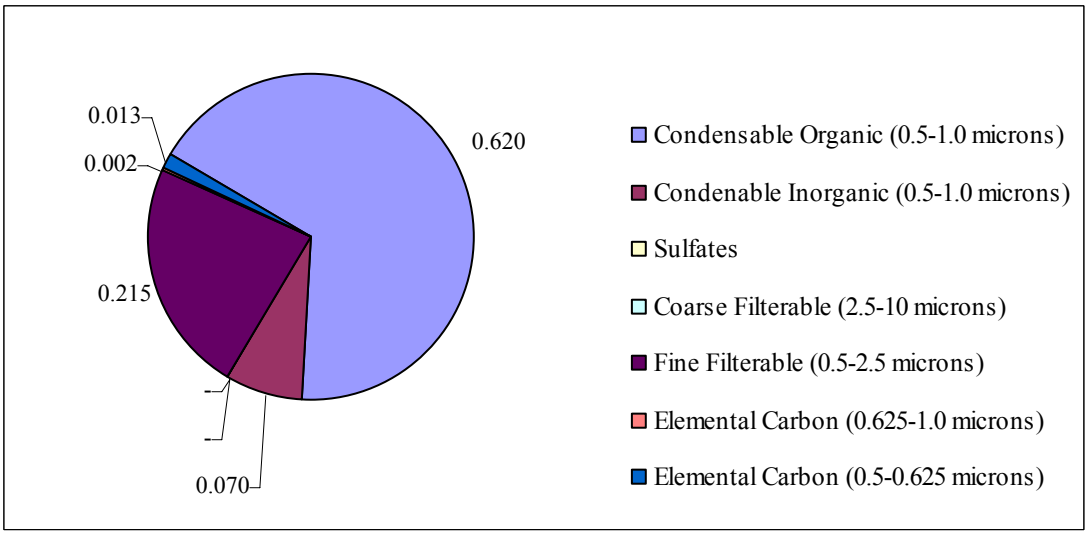


FIGURE 2-3. GIRDLER TPM_{10} SPECIATION (LB/HR)



2.2.2 WASTE INCINERATOR PARTICULATE SPECIATION

Honeywell operates the distillate-fired waste incinerator (Permit Emission Unit 42A) without an add-on PM control device. The waste incinerator is authorized to combust waste from the Specialty Chemicals area. Particulate emissions occur through combustion of this waste. To speciate the PM emissions from this source, Honeywell utilized PM size fractions and CPM emissions information from Section 1.3 of U.S. EPA's *AP-42* emission factor database.[8] Honeywell also referred to the National Park Service (NPS) guidance for speciation of oil-fired combustion sources.[9] This guidance was subsequently revised by the National Park Service to indicate that only 7.4% of the fine, filterable PM is EC.[10] Table 2-7 summarizes the relevant data for this category of sources.

TABLE 2-7. WASTE INCINERATOR SPECIATION DATA

Speciation Data	Value	Reference
EC as a % of Fine PM_{10}	7.4%	NPS Guidance for Fuel Oil Combustion
Organic portion of CPM	35.0%	AP-42 Section 1.3, Tables 1.3.1, 1.3.2, 1.3.7 Fuel Oil Combustion, Distillate-Fired Boilers*
Inorganic portion of CPM	65.0%	
TPM_{10} as a % of TSP	120.0%	
Filterable portion of TPM_{10}	45.8%	
Condensable portion of TPM_{10}	54.2%	
$PM_{6\text{-}10}$ as a % of PM_{10}	10.9%	
$PM_{2.5\text{-}6}$ as a % of PM_{10}	12.7%	
$PM_{1.25\text{-}2.5}$ as a % of PM_{10}	7.3%	
$PM_{1\text{-}1.25}$ as a % of PM_{10}	1.8%	
$PM_{0.625\text{-}1}$ as a % of PM_{10}	3.6%	
$PM_{0.5\text{-}0.625}$ as a % of PM_{10}	63.6%	

Using the information presented in Table 2-7, Honeywell first calculated TPM_{10} emissions by multiplying the maximum hourly TSP emission rate of 0.73 lb/hr by 120.0%, yielding 0.88 lb/hr TPM_{10}. $TPM_{2.5}$ emissions were calculated based on TPM_{10} emissions minus coarse filterable PM_{10} emissions ($PM_{6\text{-}10}$ and $PM_{2.5\text{-}6}$).

Next, the organic CPM emissions were determined by multiplying the calculated TPM_{10} emissions by the condensable % of TPM_{10} and the organic % of CPM. Organic CPM was assumed to be evenly split between the two size categories, 0.625-1.0 μm and 0.5-0.625 μm. The organic CPM calculation is shown below.

[8] AP-42, Section 1.3, *Fuel Oil Combustion,* Tables 1.3-1, 1.3-2, 1.3-7, September 1998.

[9] http://www2.nature.nps.gov/air/permits/emissions_ControlTech.cfm

[10] Electronic correspondence from Mr. Don Shepherd (NPS) to Mr. Michael Kiss (Virginia DEQ) dated May 5, 2006.

$$\left(0.88\frac{\text{lb TPM}_{10}}{\text{hr}}\right)\left(54.2\%\frac{\text{CPM}}{\text{TPM}_{10}}\right)\left(35.0\%\frac{\text{organic CPM}}{\text{CPM}}\right)/2 = 0.083\frac{\text{lb organic CPM for each size category}}{\text{hour}}$$

Non-sulfate inorganic CPM emissions were calculated based on subtracting the organic CPM emissions and the H_2SO_4 emissions (which were based on 1% conversion of fuel sulfur to sulfate) from the total CPM emissions. The non-sulfate inorganic CPM emissions were split evenly between the two size categories, 0.625-1.0 μm and 0.5-0.625 μm.

$$\left[\left(0.88\frac{\text{lb TPM}_{10}}{\text{hr}}\right)\left(54.2\%\frac{\text{CPM}}{\text{TPM}_{10}}\right)\left(65.0\%\frac{\text{inorganic CPM}}{\text{CPM}}\right) - 0.15\frac{\text{lb SO}_4}{\text{hr}}\right]/2 = 0.078\frac{\text{lb PIC for each size category}}{\text{hour}}$$

Filterable PM_{10} emissions were divided amongst six different size categories by multiplying TPM_{10} emissions by the filterable percentage and then by the percentage of PM_{10} for each size category, yielding hourly emissions of $PM_{6\text{-}10}$, $PM_{2.5\text{-}6}$, $PM_{1.25\text{-}2.5}$, $PM_{1\text{-}1.25}$, $PM_{0.625\text{-}1}$, and $PM_{0.5\text{-}0.625}$. For fine particulate emissions, PM less than 2.5 microns, the calculated emissions must also be multiplied by the portion of fine particulate that is not EC, i.e., 100% - 7.4%, since EC is included in the percentages of filterable PM shown in Table 2-7 for $PM_{1.25\text{-}2.5}$, $PM_{1\text{-}1.25}$, $PM_{0.625\text{-}1}$, and $PM_{0.5\text{-}0.625}$.

Sample calculations for $PM_{6\text{-}10}$ and $PM_{1.25\text{-}2.5}$ are shown below.

$$\left(0.88\frac{\text{lb TPM}_{10}}{\text{hr}}\right)\left(45.8\%\frac{\text{PM}_{10}}{\text{TPM}_{10}}\right)\left(10.9\%\frac{\text{PM}_{6\text{-}10}}{\text{PM}_{10}}\right) = 0.044\frac{\text{lb PM}_{6\text{-}10}}{\text{hour}}$$

$$\left(0.88\frac{\text{lb TPM}_{10}}{\text{hr}}\right)\left(45.8\%\frac{\text{PM}_{10}}{\text{TPM}_{10}}\right)\left(7.3\%\frac{\text{PM}_{1.25\text{-}2.5}}{\text{PM}_{10}}\right)\left(100 - 7.4\%\frac{\text{EC}}{\text{PM}_{10}}\right) = 0.027\frac{\text{lb PM}_{1.25\text{-}2.5}}{\text{hour}}$$

$$\left(0.88\frac{\text{lb TPM}_{10}}{\text{hr}}\right)\left(45.8\%\frac{\text{PM}_{10}}{\text{TPM}_{10}}\right)\left(7.3\%\frac{\text{PM}_{1.25\text{-}2.5}}{\text{PM}_{10}}\right)\left(7.4\%\frac{\text{EC}}{\text{PM}_{10}}\right) = 0.0022\frac{\text{lb EC}_{1.25\text{-}2.5}}{\text{hour}}$$

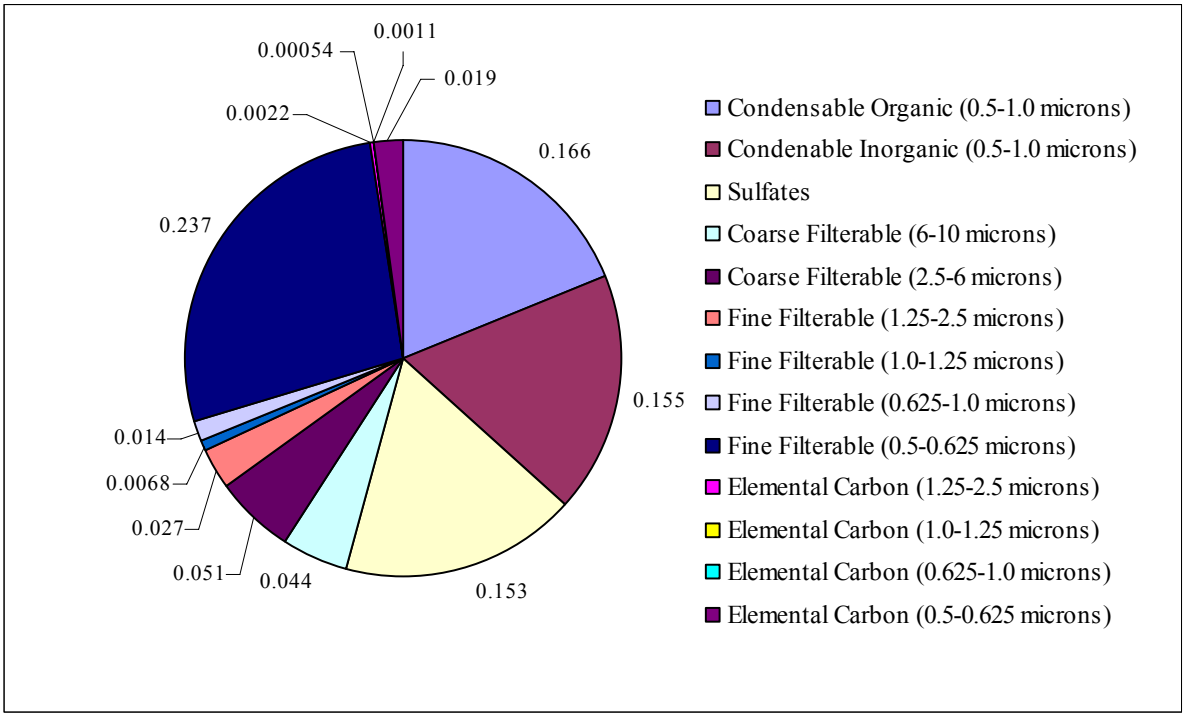
All EC was presumed to be divided amongst the size categories based on the AP-42 percentages.

Table 2-8 presents a summary of the speciated PM emissions for the waste incinerator. Figure 2-4 presents graphical representations of the speciated TPM_{10} emissions of 0.88 lb/hr for the waste incinerator.

TABLE 2-8. WASTE INCINERATOR PM SPECIATED EMISSIONS (LB/HR)

POC (μm)		PIC (non-sulfate) (μm)			PMC (μm)		PMF (μm)				EC (μm)			
0.625-1.0	0.5-0.625	0.625-1.0	0.5-0.625	SO_4	6-10	2.5-6	1.25-2.5	1.0-1.25	0.625-1.0	0.5-0.625	1.25-2.5	1.0-1.25	0.625-1.0	0.5-0.625
0.083	0.083	0.078	0.078	0.15	0.044	0.051	0.027	0.0068	0.014	0.24	0.0022	0.00054	0.0011	0.019

FIGURE 2-4. WASTE INCINERATOR TPM_{10} SPECIATION (LB/HR)



2.2.3 AMMONIUM NITRITE AND HYDROXYLAMINE DISULFONATE TRAINS PARTICULATE SPECIATION

Honeywell operates three BART-eligible ammonium nitrite trains (Permit Emission Units 90C, 90D, and 90E) and three BART-eligible hydroxylamine disulfonate trains (Permit Emission Units 91C, 91D, and 91E). In these process units, ammonia (in the nitrite trains) and sulfur (in the disulfonate trains) is combusted as part of the chemical production process. With the exception of the C train nitrite, each process unit has a wet scrubber that absorbs exhaust gases in a carbonate solution at near ambient temperature. The same chemistry occurs in the C train nitrite tower, but has a higher emission rate to the atmosphere due to the lack of a wet scrubber.

Honeywell determined there are no EC emissions since there is no fuel-bound carbon in the process and the PM emissions are inorganic condensable forms of nitrites, nitrates, sulfates, and carbonates. Therefore, PM from the Hydroxylamine Disulfonate process units were conservatively represented as primary sulfate emissions since such emissions are explicitly modeled in CALPUFF as a hygroscopic species with potentially considerable visibility impairment effects. Similarly, PM from the Ammonium Nitrite process units units were conservatively represented as primary nitrate emissions since such emissions are explicitly modeled in CALPUFF as a hygroscopic species with potentially considerable visibility impairment effects. Table 2-9 summarizes the relevant speciation data for the Ammonium Nitrate Trains and Table 2-10 summarizes the relevant speciation data for the Hydroxylamine Disulfonate Trains.

TABLE 2-9. AMMONIUM NITRITE TRAIN PM SPECIATED EMISSIONS (LB/HR)

Train	Primary NO_3
C	6.58
D	0.16
E	0.16

TABLE 2-10. HYDROXYLAMINE DISULFONATE TRAIN PM SPECIATED EMISSIONS (LB/HR)

Train	Primary SO_4
C	1.08
D	0.92
E	0.83

2.2.4 SULFURIC ACID PLANT PARTICULATE SPECIATION

Honeywell operates a sulfuric acid plant (Permit Emission Unit 14A) with no add-on control device for PM. The TPM_{10} emissions of 0.5 lb/hr were conservatively assumed to be entirely in the form of primary sulfate emissions as sulfuric acid mist.

2.3 MODELED STACK PARAMETERS AND EMISSIONS

Actual stack parameters were input to the CALPUFF model to represent the point of visibility-affecting pollutant emissions. The location of each point source will be represented consistently in the Lambert Conformal Coordinate system used for the screening and refined meteorological data analyses prepared by VISTAS. Each exhaust discharges vertically without obstruction. Since the nearest Class I area is located more than 150 km to the facility, effects of building downwash were not considered. Table 2-11 summarizes the stack parameters and Table 2-12 summarizes the modeled PM emission rates for BART-eligible emission units at Honeywell's Hopewell Plant in addition to the SO_2, NO_X, and NH_3 emission rates summarized in Table 2-2. Because none of the BART-eligible emission units have a stack height greater than the nominal Good Engineering Practice (GEP) stack height of 65 meters, all stacks were modeled at their actual release height.

TABLE 2-11. STACK PARAMETERS FOR BART-ELIGIBLE EMISSION UNITS

Emission Unit	Stack ID	LCC East (km)	LCC North (km)	Stack Height (feet)	Stack Diameter (feet)	Exhaust Temperature (°F)	Exhaust Velocity (feet/sec)
FU-1 Kellogg Reformer	103	1,722.333	-110.650	105	11.30	238	44.89
FU-6 Girdler	106	1,722.333	-110.650	50	5.00	320	21.66
FU-14 Hazardous Waste Incinerator	405	1,722.333	-110.650	150	2.50	185	40.74
Ammonium Nitrite "C" Train	902	1,722.333	-110.650	125	1.33	41	114.09
Ammonium Nitrite "D" Train	903	1,722.333	-110.650	125	1.33	41	114.09
Ammonium Nitrite "E" Train	904	1,722.333	-110.650	115	2.00	41	65.25
Hydoxylamine Disulfonate "C" Train	907	1,722.333	-110.650	132	2.00	59	59.95
Hydoxylamine Disulfonate "D" Train	908	1,722.333	-110.650	132	2.00	63	59.95
Hydoxylamine Disulfonate "E" Train	909	1,722.333	-110.650	112	2.00	63	76.96
Sulfuric Acid Plant	108	1,722.333	-110.650	185	5.00	100	55.20

TABLE 2-12. MODELED PM EMISSION RATES (POUNDS PER HOUR) FOR BART-ELIGIBLE EMISSION UNITS

Emission Unit	ID	POC		PIC		PMC		PMF				EC				NO_3	SO_4
		0.625-1.0 µm	0.5-0.625 µm	0.625-1.0 µm	0.5-0.625 µm	6-10 µm	2.5-6 µm	1.25-2.5 µm	1.0-1.25 µm	0.625-1.0 µm	0.5-0.625 µm	1.25-2.5 µm	1.0-1.25 µm	0.625-1.0 µm	0.5-0.625 µm		
FU-1 Kellogg Reformer	103	3.37	3.37	0.38	0.38	--	--	--	--	0.35	1.98	--	--	0.025	0.14	--	--
FU-6 Girdler	106	0.31	0.31	0.035	0.035	--	--	--	--	0.032	0.18	--	--	0.0023	0.013	--	--
FU-14 Hazardous Waste Incinerator	405	0.083	0.083	0.078	0.078	0.044	0.051	0.027	0.0068	0.014	0.24	0.027	0.0068	0.014	0.24	--	0.15
Ammonium Nitrite "C" Train	902	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.58	--
Ammonium Nitrite "D" Train	903	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.16	--
Ammonium Nitrite "E" Train	904	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.16	--
Hydoxylamine Disulfonate "C" Train	907	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.08
Hydoxylamine Disulfonate "D" Train	908	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.92
Hydoxylamine Disulfonate "E" Train	909	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.83
Sulfuric Acid Plant	108	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.50

Section 3 of this BART Applicability Analysis report for Honeywell's Hopewell Plant describes the modeling methods, data resources, and technical options used to conduct screening and refined analyses to assess visibility impacts. Air quality modeling was conducted generally following the methods described in the *VISTAS BART Modeling Protocol* as revised, with exceptions as described in this section.

3.1 AIR QUALITY MODELING SYSTEM

CALPUFF is a multi-layer, multi-species, non-steady-state Lagrangian puff model, which can simulate the effects of time- and space-varying meteorological conditions on pollutant transport, transformation, and removal. The modeling system is designed to handle the complexities posed by the complex terrain, the large source-receptor distances, chemical transformation and deposition, and other issues related to Class I visibility impacts. A complete description of the model formulation and capabilities is provided in the *User's Guides* for the CALPUFF modeling system and the *VISTAS BART Modeling Protocol*.

The CALPUFF modeling system has been adopted by the U.S. EPA as a recommended regulatory guideline model for source-receptor distances greater than 50 km, and for use on a case-by-case basis in complex flow situations for shorter distances. CALPUFF is recommended for Class I area impact assessments by the Interagency Workgroup on Air Quality Models (IWAQM). The U.S. EPA's BART guidance recommends CALPUFF as "the best modeling application available for predicting a single source's contribution to visibility impairment."

As a result of these recommendations, the *VISTAS BART Modeling Protocol* was based on the use of CALPUFF and was used by Honeywell for the source-specific analysis of visibility impacts attributable to the Hopewell Plant. Specifically, CALMET Version 5.726/060414, CALPUFF Version 5.756/060725, POSTUTIL Version 1.52/060412, and CALPOST Version 5.6393/060202 were designated as the "VISTAS Recommended Version for BART Modeling" by the VISTAS Technical Contractor and were used in the CALPUFF BART Applicability Analyses for Honeywell's Hopewell Plant.[11]

3.2 SCREENING AND REFINED ANALYSIS TECHNIQUES

The *VISTAS BART Modeling Protocol* distinguishes between screening and refined applications of the CALPUFF model for the purposes of BART Applicability Analyses. As the names of these techniques imply, screening analyses are intended to provide a conservative estimate of visibility impacts using computationally efficient techniques. The refined analyses utilize less conservative and more representative data and modeling methods to compute visibility impacts following U.S. EPA's BART guidelines. Screening analyses may be used to determine that a facility is not subject to

[11] http://src.com/verio/download/download.htm#VISTAS_VERSION

BART using a conservative assessment, or to focus the scope of refined analyses by demonstrating that visibility impairment is not likely to occur at more distant Class I areas.

Although certain elements of the modeling analyses are identical regardless of which approach is used (e.g., representation of emissions sources, chemical transformation algorithms, Class I area receptors), the *VISTAS BART Modeling Protocol* makes several important distinctions between screening and refined analyses.

3.2.1 VISIBILITY ASSESSMENT METRIC

The U.S. EPA BART guidelines prescribe that the 98th percentile, 24-hour average visibility impact computed in a modeling analysis that evaluates three years of meteorological data should be compared to the contribution threshold of 0.5 dv to assess BART applicability. The *VISTAS BART Modeling Protocol* prescribes two different comparison metrics, depending on whether the screening or refined analysis is completed. For the screening analysis, VISTAS specifies that the maximum computed visibility impact is the basis for comparison to ensure that the modeled result is a conservative representation of visibility impairment. For the refined analysis, the comparison is more complex. VISTAS describes the impact threshold as the "98th percentile (8th-highest annual) 24-hour average predicted impact at the Class I area…the predicted impact at the Class I area on any day is taken to be the highest 24-hr average impact at any receptor in the Class I area on that day. (Note that the receptor where the highest impact occurs can change from day to day.)"

The default VISTAS CALPOST processing of modeled visibility impacts outputs a summary table of this result, ranking the highest 24-hour average impacts for the year at each Class I area, from which the 8th-highest impact can be readily discerned. The VISTAS refined approach may also consider the 22nd-highest 24-hour average visibility impact over the three years modeled if this result is more conservative. Honeywell utilized both the default conservative 98th percentile calculations to quantify visibility impacts in refined modeling analyses to illustrate the distribution (i.e., frequency, duration, and magnitude) of peak visibility impairment episodes attributable to the Hopewell Plant for comparison against the 0.5 dv contribution threshold.

3.2.2 METEOROLOGICAL AND COMPUTATIONAL GRIDS

The *VISTAS BART Modeling Protocol* prescribes that screening analyses be conducted on a 12-km meteorological and computational grid and that refined analyses be conducted on a 4-km meteorological and computational grid. The resolution of the computational analysis dictates the extent to which geophysical (i.e., terrain and land use) and meteorological conditions are represented in the CALMET meteorological model, hence the advection, dispersion, and chemical transformation of visibility-affecting pollutants in the CALPUFF meteorological model. The VISTAS Technical Contractor conducted meteorological modeling using both screening 12-km and refined 4-km grids to provide common data resources to eligible sources conducting BART Applicability Analyses, which were used by Honeywell to assess visibility impacts attributable to the Hopewell

Plant. The following section of this report describes the CALMET meteorological modeling in greater detail.

3.2.3 MODEL PROCESSING AND POSTPROCESSING METHODS

The IWAQM *Phase 2 Report* prescribes recommended default model processing options to be used in CALPUFF analyses, which are in most cases considered regulatory default options under U.S. EPA's *Guideline on Air Quality Models*. IWAQM default model options as described in the following section of this report were prescribed for use in both screening and refined analyses. The *VISTAS BART Modeling Protocol* and Honeywell's source-specific modeling protocol envisioned the possible use of puff-splitting algorithms to represent wind shear effects and differential rates of transport of well-mixed puffs that grow beyond the size of a grid cell. Puff splitting algorithms are computationally demanding and for some applications may require changes to the default parameter settings in CALPUFF to allow more than the default number of split puffs. Puff splitting was evaluated and found not to significantly change modeled impacts in this application despite the modest distance between Hopewell Plant and the nearest Class I area, Shenandoah, at approximately 158 km distant. Therefore, the default model option to disable puff splitting was used in both screening and refined analyses.

In the postprocessing of CALPUFF-computed concentrations of visibility-affecting pollutants, the POSTUTIL postprocessing utility can be used to apply the ammonia limiting method by re-partitioning the distribution of HNO_3 and NO_3 concentrations at each Class I area as a function of the temperature and relative humidity during each hour. ALM processing is not run by default, and therefore was not used in the screening analyses. ALM re-partitioning using the default ammonia background level of 0.5 ppb was conducted in refined analyses as described by the *VISTAS BART Modeling Protocol*. Note that primary NH_3 emissions were also modeled from the Hopewell Plant and concentrations from the modeled emissions were included in the re-partitioning calculation as described in Section 3.5.1 of this report.

3.3 CALMET METEOROLOGICAL PROCESSING

CALMET is the meteorological preprocessor that compiles three-dimensional meteorological fields from mesoscale model (MM) output, raw observations of surface and upper air conditions, precipitation measurements, and geophysical parameters into a single hourly, gridded data set for input to CALPUFF. The *CALMET User's Guide* and *VISTAS BART Modeling Protocol* provide a detailed description of the model's formulation and capabilities.

The federal *Guideline* for CALPUFF processing provides the following recommendations for the meteorological data period at Section 9.3.1.2:

> *Less than five, but at least three, years of meteorological data (need not be consecutive) may be used if mesoscale meteorological fields are available, as discussed in paragraph 9.3(c). These mesoscale meteorological fields should be used*

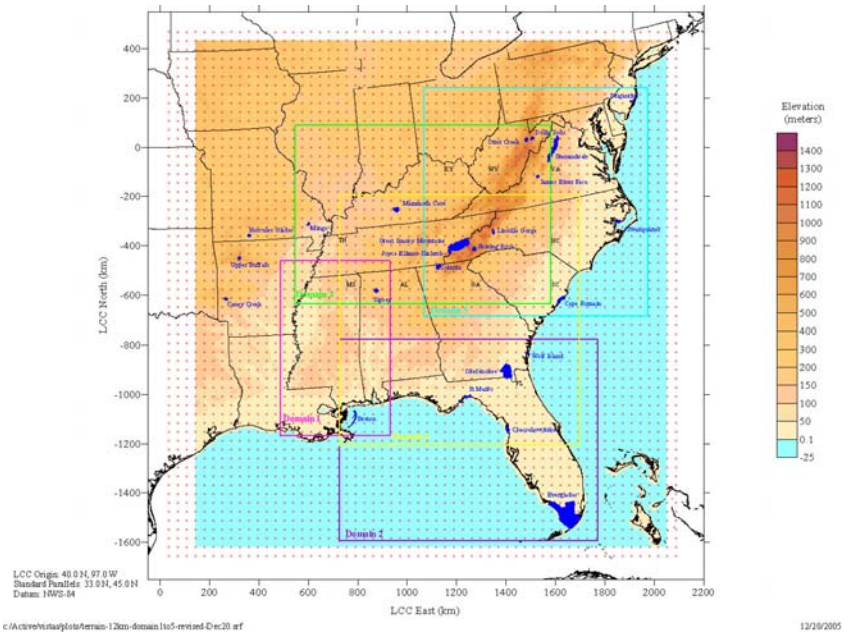
in conjunction with available standard [National Weather Service] NWS or comparable meteorological observations within and near the modeling domain.

The *VISTAS BART Modeling Protocol* prescribes the years 2001 through 2003 for BART Applicability Analyses. The primary basis for this data analysis period was the availability of quality assured MM5 data for the entire VISTAS area. For its BART Applicability Analyses, Honeywell utilized 12-km screening and 4-km CALMET data prepared by the VISTAS Technical Contractor using the following data resources and CALMET modeling techniques.

3.3.1 CALMET METEOROLOGICAL DOMAINS

12-km screening and 4-km refined CALMET meteorological data sets were prepared for the domains depicted in Figures 3-1. Honeywell's BART Applicability Analyses utilized the Regional Screening Domain 0 for 12-km screening analyses and Refined Sub-regional Domain 5 for the 4-km refined analyses. The CALPUFF computational domains were selected as a subset of these domains as described in the following section of this report.

FIGURE 3-1. 12-KM REGIONAL SCREENING ANALYSIS AND 4-KM SUB-REGIONAL REFINED ANALYSIS CALMET DOMAINS



The VISTAS Regional Domain 0 was designed to allow any Class I areas within the VISTAS area to be evaluated with a single meteorological database and consistent CALPUFF modeling options. The horizontal domain is comprised of grid cells, each containing a central grid point at which meteorological and computational parameters are calculated at each time step. For the initial regional analysis, a grid spacing interval of 12 km was selected. The LCC projection system is used to describe the horizontal grid, with origin at 40 degrees North latitude and 97 degrees West longitude. Standard parallels for the projection were set at 33 degrees North and 45 degrees North.

Table 3-1 summarizes the vertical grid structure selected for this analysis, which comprises ten vertical layers. The cell face height of each layer indicates its vertical extent. The vertical domain is composed of terrain-following grid cells, the number and size of which are chosen so as to constrain the boundary layer in which dispersion and chemical transformations take place. The highest cell face was selected to be 4,000 meters to constrain the default maximum mixing height of 3,000 meters.

TABLE 3-1. VERTICAL GRID STRUCTURE

Vertical Grid Cell	Cell Face Height (meters)
1	20
2	40
3	80
4	160
5	320
6	640
7	1,200
8	2,000
9	3,000
10	4,000

Refined 4-km analyses were also conducted using this vertical grid structure. Sub-regional Domain 5, which Honeywell utilized for its refined analyses, contains all of Virginia, West Virginia, and North Carolina in which the BART-eligible source and potentially affected Class I areas are located.

3.3.2 MM5 SIMULATIONS

MM data are used as "observed" or "first-guess" fields in CALMET due to its high-resolution representation of meteorological conditions on a uniform three-dimensional grid. The following three years of MM5 meteorological data were assembled by VISTAS for use in the regional CALPUFF modeling effort:

- 2001 MM5 dataset at 12 km and 36 km grid (developed for EPA)
- 2002 MM5 dataset at 12 km and 36 km grid (developed by VISTAS)
- 2003 MM5 dataset at 36 km grid (developed by the Midwest Regional Planning Organization).

These data sets were provided to the VISTAS Technical Contractor, which produced three-dimensional, CALMET-ready meteorological files for the VISTAS domain, which were subsequently used to run CALMET for the 12-km screening and 4-km sub-regional refined analyses.

3.3.3 GEOPHYSICAL DATA

According to the *VISTAS BART Modeling Protocol*, terrain elevations within the modeling domain were processed from SRTM-GTOPO30 digital terrain data format with 30-arcsec

resolution. SRTM30 is a digital elevation data set that spans the globe from 60° north latitude to 56° south latitude, approximately from the southern tip of Greenland to below the southern tip of South America. It has a horizontal grid spacing of 30 arc-seconds (approximately 1 kilometer). GTOPO30 is a global digital elevation model with a horizontal grid spacing of 30 arc-seconds (approximately 1 kilometer) that was derived from several raster and vector sources of topographic information that include U.S. Geological Survey (USGS) digital elevation models. The VISTAS Technical Contractor used data preprocessors to format and assimilate these data into a single geophysical data file for processing by CALMET to generate the 12-km screening data set. According to the *VISTAS BART Modeling Protocol*, higher resolution 3 arc-second DEM data were used to simulate terrain elevations in the 4-km refined data set.

Land use and land cover (LULC) within the modeling domain was assimilated by the VISTAS technical contractor into a single geophysical data file for processing by CALMET using Composite Theme Grid (CTG) data archived by the USGS at a resolution of 200 meters. CALMET was used to calculate the fractional land use types within each cell of the CALMET grid. LULC in each grid cell was used by CALMET to compute the micrometeorological parameters (i.e., surface roughness, Bowen ratio, albedo, soil heat flux) that affect turbulent dispersion in the boundary layer. According to the *VISTAS BART Modeling Protocol*, 200-meter CTG LULC data were utilized for both 12-km screening and 4-km refined analyses.

3.3.4 12-KM SCREENING ANALYSIS CALMET PROCESSING

The development of the regional screening CALMET meteorological fields from MM5 data were conducted in No-Observations ("No-Obs") mode since the MM5 data already reflect assimilation of observational data and are likely to adequately characterize regional wind patterns that are consistent with the 12-km grid scale.

When the 12-km MM5 (2001 and 2002) data are used, the diagnostic CALMET terrain adjustments were turned off since the grid resolution of the MM5 data is the same as the CALMET grid and the terrain adjustments on the 12-km grid scale will already be reflected in the MM5 dataset. In this case, the MM5 winds were interpolated by CALMET to the CALMET layers and CALMET's boundary layer modules computed mixing heights, turbulence parameters, and other meteorological parameters that are required by CALPUFF. For 2003, the 36-km MM5 data were used as CALMET's initial guess field and then the CALMET diagnostic terrain adjustments (see Section 3.1.1 of the *VISTAS BART Modeling Protocol*) were applied to reflect terrain on the scale of the CALMET grid (i.e., 12 km).

3.3.5 4-KM REFINED GRID CALMET PROCESSING

The finer grid (4 km) CALMET simulations were run by the VISTAS Technical Contractor in hybrid mode, using MM5 data to define the initial guess fields, diagnostic terrain adjustments to create the Step 1 wind fields, and NWS meteorological observational data in the Step 2 smoothing calculations. In this manner, actual observations of three-dimensional meteorological conditions were used in the model to smooth the coarse MM5

resolution to better represent areas in which terrain features and coastlines may have an important effect on meteorological conditions, but not be well resolved in the mesoscale model. Surface, upper air, precipitation, and offshore buoy observation points are readily available for use in CALMET. The following generally describes the use of NWS observations in Step 2 of the CALMET analyses.

Parameters affecting turbulent dispersion that are observed hourly at surface stations include wind speed and direction, temperature, cloud cover and ceiling, relative humidity, and precipitation type. Surface data were selected from the available data inventory to optimize spatial coverage and representation of the domain. Raw observations were obtained from the National Climatic Data Center (NCDC), quality assured, and merged using the SMERGE pre-processor to create a single assimilated data file of surface observations for each year analyzed.

Observations of meteorological conditions in the upper atmosphere provide a profile of turbulence from the surface through the depth of the boundary layer in which dispersion occurs. In general, twice-daily upper air data are collected by balloons launched simultaneously across the observation network at 0000 Greenwich Mean Time (GMT) and 1200 GMT, which correspond to 7:00pm and 7:00am, respectively in the Eastern Time Zone, including Virginia. In CALMET analyses, the VISTAS Technical Contractor used Eastern Standard Time Zone (GMT-5) as the base time zone for all analyses, in which twice daily upper observations correspond to 7:00pm and 7:00am, respectively.[12] Honeywell presumes the meteorological data provided by VISTAS were prepared using appropriate representations of meteorological observations from different time zones within the modeling domains. Sensors observe pressure, wind speed and direction, and temperature (among other parameters) as the balloon rises through the atmosphere. The upper air observation network is less dense than surface observation points since upper air conditions vary less and are generally not as affected by local effects (e.g., terrain or coastlines). Upper air data were extracted from the NCDC's available data inventory to optimize spatial coverage and representation of the domain, and utilization from year to year may vary due to availability and data quality.

The effects of wet deposition processes on ambient pollutant concentrations are an important part of the BART Applicability Analysis. Therefore, it was necessary to include observations of precipitation in the CALMET analysis. Precipitation data were collected from selected surface meteorological data stations included in the analysis, plus Cooperative Observation Network (COOP) stations nearer to or within the domain. Precipitation data were extracted from among the NCDC's available data inventory to optimize spatial coverage and representation of the domain. Raw observations from these stations were quality assured and merged using the PMERGE pre-processor to create a single assimilated data file of precipitation observations.

[12] http://src.com/verio/download/Files/dom4/met2001-dom4-01a.inp.

3.3.6 QUALITY ASSURANCE OF CALMET ANALYSES

Honeywell's BART Applicability Analyses were conducted using 12-km screening and 4-km refined CALMET data prepared by the VISTAS Technical Contractor. The *VISTAS BART Modeling Protocol* describes quality assurance techniques used by the contractor to validate the model's performance.

3.4 CALPUFF MODEL PROCESSING

CALPUFF analyses to assess the visibility impacts attributable to Honeywell's Hopewell Plant were conducted generally in accordance with the recommendations of IWAQM *Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts*, Appendix B of which provides recommended default CALPUFF parameters. Appendix A of this BART Applicability Analysis report contains sample 12-km screening and 4-km refined CALPUFF input files that can be compared to the IWAQM recommendations to demonstrate that default options were used, including the following important model options.

3.4.1 MODELED EMISSIONS AND CHEMICAL TRANSFORMATIONS

Section 2 of this BART Applicability Analysis report described the BART-eligible emission units operated at Honeywell's Hopewell Plant and the visibility-affecting pollutants considered in the CALPUFF analysis. Emission rates were calculated following U.S. EPA and Virginia DEQ BART guidance for primary emissions of SO_2, H_2SO_4, NO_X and PM_{10}. PM was further speciated into size categories of less than 0.625 µm, 0.625-1.0 µm, 1.0-1.25 µm, 1.25-2.5 µm, 2.5-6.0 µm and 6-10 µm aerodynamic diameters. Industry-specific emission factors were utilized to analyze the phase, size, and character of PM emissions as described in Section 2 of this report.

Although not a default modeling technique, primary emissions of NH_3 and NO_3 were modeled from certain of Honeywell's BART-eligible emission units. NH_3 was explicitly modeled because the Hopewell Plant is one of 13 large NH_3 sources in the VISTAS region that were required to include primary NH_3 emissions in the BART Applicability Analyses. Primary NO_3 emissions were explicitly modeled because NO_3 is a hygroscopic visibility-affecting pollutant and PM emissions from certain process units were most conservatively represented assuming all CPM is in the form of nitrate. In addition to pollutants emitted directly from the Hopewell Plant, secondary formation of HNO_3, NO_3, and SO_4 was simulated using the MESOPUFF-II chemical transformation algorithms, which are considered the default for regulatory CALPUFF modeling. Background levels of ozone and NH_3, which drive the simulated chemical transformation of emitted pollutants into visibility affecting species, were input to the model as described in subsequent sections of this report.

Honeywell operates ten BART-eligible emission units at the Hopewell Plant evaluated in this BART Applicability Analysis, as described in Section 2 of this report as having ten distinct emission release points and characteristics. Sample model processing files provided by the VISTAS Technical Contractor demonstrate modeling of a single point

source using CALPUFF, POSTUTIL, and CALPOST to assess visibility change.[13] The sample approach simulates actual emissions of each of three gaseous pollutants (SO_2, SO_4, and NO_X) and unit emissions (e.g., 1 g/s) of each of six generic particle categories distinguished and designated by size: PM800, PM425, PM187, PM112, PM081, and PM056, to represent $PM_{6\text{-}10}$, $PM_{2.5\text{-}6}$, $PM_{1.25\text{-}2.5}$, $PM_{1\text{-}1.25}$, $PM_{0.625\text{-}1}$, and $PM_{0.5\text{-}0.625}$, respectively. The size distribution is the only distinguishing feature of these particle categories. Table 3-2 summarizes the relevant model input parameters for each size category.

TABLE 3-2. REPRESENTATION OF PM SIZE CATEGORIES IN CALPUFF

Model Species	Computed Deposition Mode	Geometric Mass Mean Diameter (microns)	Geometric Standard Deviation (microns)*	Precipitation Scavenging Coefficient Liquid (s^{-1})	Precipitation Scavenging Coefficient Frozen (s^{-1})
PM800	Particle	8.00	0	1.0×10^{-4}	3.0×10^{-5}
PM425	Particle	4.25	0	1.0×10^{-4}	3.0×10^{-5}
PM187	Particle	1.87	0	1.0×10^{-4}	3.0×10^{-5}
PM112	Particle	1.12	0	1.0×10^{-4}	3.0×10^{-5}
PM081	Particle	0.81	0	1.0×10^{-4}	3.0×10^{-5}
PM056	Particle	0.56	0	1.0×10^{-4}	3.0×10^{-5}

* Zero geometric standard deviation indicates that CALPUFF utilizes the deposition velocity associated with the geometric mass mean diameter.

Because unit emission rates were modeled from the single point source in the sample approach, actual emission rates were used in the POSTUTIL postprocessing step to combine PM types and sizes into light scattering groups by scaling the modeled concentrations up or down by the multiplicative factor of the actual emission rate of each PM size category, which includes multiple types of PM (e.g., coarse filterable PM, fine filterable PM, organic condensable PM, inorganic condensable PM, and elemental carbon). The output concentration file from POSTUTIL was then input to CALPOST to calculate visibility change attributable to emissions from the point source in the sample analysis.

The preceding approach is reasonable for modeling a single point source; however, for facilities with multiple emission point sources, the preceding approach is not appropriate. Specifically, for sources with multiple emission points that have different exhaust characteristics (e.g., stack height, diameter, velocity, and temperature) and/or different emissions profiles of speciated PM, the use of unit emission rates from each source is not appropriate since the CALPUFF output concentrations at particular receptors will not distinguish which source(s) contribute to the PM concentrations. Therefore, the POSTUTIL source profile technique cannot be applied. One alternative to this approach for sources with multiple emission points is to model each emission point individually in multiple CALPUFF runs using unit emission rates, then run POSTUTIL to combine the PM concentrations at each receptor for each modeled emission point, finally running the CALSUM postprocessing utility (or a second application of POSTUTIL) to combine the

[13] http://www.src.com/verio/download/sample_files.htm#EXAMPLE_BART

impacts of all sources. This approach, though conceptually appropriate, is undesirable due to substantial additional computer runtime required to model and post-process each emission point individually.

As a computationally efficient alternative to the preceding approaches, the BART Applicability Analyses for Honeywell's Hopewell Plant were conducted by explicitly modeling in CALPUFF the actual emission rate of each of 14 particle species defined as described in Table 3-3. The nomenclature used in Table 3-3 is analogous to that used to describe the emissions from Honeywell's BART-eligible emission units in Section 2 of this report.

TABLE 3-3. EXPLICIT MODELING OF PM TYPES AND SIZE CATEGORIES

Modeled PM Category	Components
PMC800 PMC425	Filterable coarse particles divided between two size categories (PM_{6-10}, $PM_{2.5-6}$)
PMF187 PMF112 PMF081 PMF056	Filterable fine particles divided among four size categories ($PM_{1.25-2.5}$, $PM_{1-1.25}$, $PM_{0.625-1}$, $PM_{0.5-0.625}$)
POC081 POC056	Primary condensable organic emissions divided between two size categories ($PM_{0.625-1}$ and $PM_{0.5-0.625}$)
PIC081 PIC056	Primary condensable inorganic emissions divided between two size categories ($PM_{0.625-1}$ and $PM_{0.5-0.625}$)
EC187 EC112 EC081 EC056	Primary elemental carbon emissions divided among four size categories ($PM_{1.25-2.5}$, $PM_{1-1.25}$, $PM_{0.625-1}$, $PM_{0.5-0.625}$)

So that explicit modeling of the 14 particle species and sizes could be conducted equivalently to the unit emissions approach, identical model processing options for each PM size category were enabled as summarized in Table 3-4.

TABLE 3-4. REPRESENTATION OF EXPLICITLY MODELED PM SIZE CATEGORIES IN CALPUFF

Model Species	Computed Deposition Mode	Geometric Mass Mean Diameter (microns)	Geometric Standard Deviation (microns)*	Precipitation Scavenging Coefficient Liquid (s^{-1})	Precipitation Scavenging Coefficient Frozen (s^{-1})
PMC800	Particle	8.0	0	1.0×10^{-4}	3.0×10^{-5}
PMC425	Particle	4.25	0	1.0×10^{-4}	3.0×10^{-5}
PMF187 EC187	Particle	1.87	0	1.0×10^{-4}	3.0×10^{-5}
PMF112 EC112	Particle	1.12	0	1.0×10^{-4}	3.0×10^{-5}
PMF081 EC081 POC081 PIC081	Particle	0.81	0	1.0×10^{-4}	3.0×10^{-5}
PMF056 EC056 POC056 PIC056	Particle	0.56	0	1.0×10^{-4}	3.0×10^{-5}

* Zero geometric standard deviation indicates that CALPUFF utilizes the deposition velocity associated with the geometric mass mean diameter.

To post-process the CALPUFF output concentrations that result from explicitly modeled multiple emission points, POSTUTIL was used only to group modeled PM into light extinction groups. Unit scaling factors were used in POSTUTIL and there was no adjustment to the explicitly modeled emission rate. Table 3-5 summarizes the POSTUTIL grouping of modeled PM species into light extinction groups, and the light extinction coefficient subsequently used in CALPOST to compute light extinction due to the multiple emission points at the source.

TABLE 3-5. ASSIGNMENT OF MODELED PM SPECIES TO LIGHT EXTINCTION GROUPS

Modeled Components	CALPOST Light Extinction Group	Extinction Coefficient (m^2/g)
PMC800 PMC425	PMC	0.6
PMF187 PMF112 PMF081 PMF056 PIC081 PIC056	SOIL	1
POC081 POC056	SOA	4
EC187 EC112 EC081 EC056	EC	10

Explicit modeling of the 14 PM types and sizes plus the SO_2, SO_4, NO_X, HNO_3, NO_3, and NH_3 species results in a total of 20 modeled species, which is within the default parameter limit of 20 species modeled (MXSPEC). As envisioned in Honeywell's initial source-specific modeling protocol, previous versions of CALPUFF (i.e., version 5.754), would have required a modification to the FORTRAN compilation; however, in the current version of CALPUFF (i.e., Version 5.756) the parameter for particle species deposited (MXPDEP) was increased from 9 to 20 to accommodate the greater number (16, including SO_4 and NO_3) of particle species simulated in the model.[14]

This modified approach follows conceptually the steps outlined in the revised *VISTAS BART Modeling Protocol* as evidenced between comparisons between the two methods. Results using the explicit method for multiple emission points and the sample method using a single point source with PM speciation (PMF, PMC, SOA, EC) applied during the POSTUTIL step provides equivalent results. The model input and output files of a sample comparative analysis are further described in Appendix C and included with the electronic media provided with this BART Applicability Analysis report to demonstrate that explicit modeling of PM emissions results in equivalent calculations of visibility impacts.

3.4.2 CALPUFF DISPERSION ALGORITHMS

As specified in a March 16, 2006 U.S. EPA memorandum[15] and the most recent revision to the *VISTAS BART Modeling Protocol*, the use of Pasquill-Gifford (ISC-like) dispersion coefficients was enabled as the default option in screening and refined CALPUFF analyses.

3.4.3 BUILDING DOWNWASH

Because the Hopewell Plant is located more than 100 km from any Class I area, the effects of building downwash were not considered in the BART Applicability Analyses.

3.4.4 CALPUFF MODELING DOMAINS AND CLASS I AREA RECEPTORS

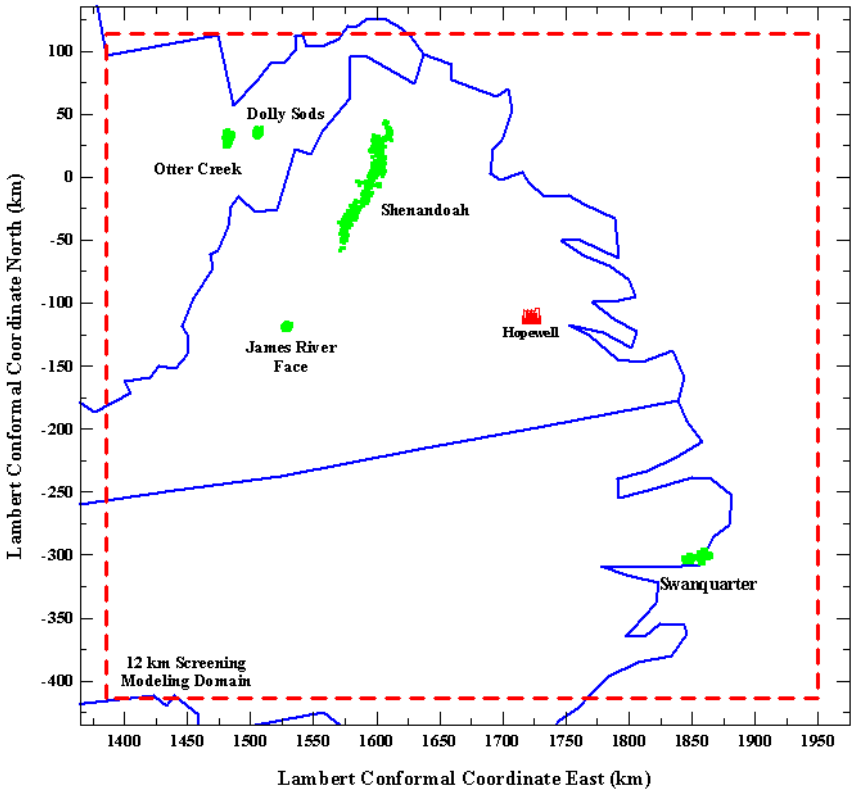
CALPUFF modeling for 12-km screening and 4-km refined analyses was performed on computational domains that are subsets of the VISTAS Regional Domain 0 and Sub-regional Domain 5. The size of each computational domain was selected to encompass the Hopewell Plant and the Class I areas being analyzed, and to extend at least 50 km beyond in all directions. The size of the domain allows for the possible recirculation of puffs beyond the facility and areas being evaluated. Computational domains use the same vertical grid structure as described in the CALMET model formulation in Section 3.3 of this report. Figures 3-2 through 3-7 illustrate the locations of, and terrain elevations and land use within, the 12-km screening and 4-km computational domains used in Honeywell's BART Applicability Analyses.

[14] http://src.com/verio/download/vistas_codes.htm

[15] U.S. EPA Memorandum "Dispersion Coefficients for Regulatory Air Quality Modeling in CALPUFF" from Mr. Dennis Atkinson and Mr. Tyler Fox (Air Quality Modeling Group) to Ms. Kay Prince (Regulatory Planning Branch) dated March 16, 2006.

The ground level receptors at which concentrations of visibility-affecting pollutants and visibility impacts were calculated at the five Class I areas within 300 km were obtained from the National Park Service as depicted in Figures 3-8 through 3-12.[16]

FIGURE 3-2. 12-KM SCREENING ANALYSIS COMPUTATIONAL DOMAIN



[16] http://www2.nature.nps.gov/air/maps/Receptors/index.htm

FIGURE 3-3. TERRAIN ELEVATIONS WITHIN THE 12-KM COMPUTATIONAL DOMAIN

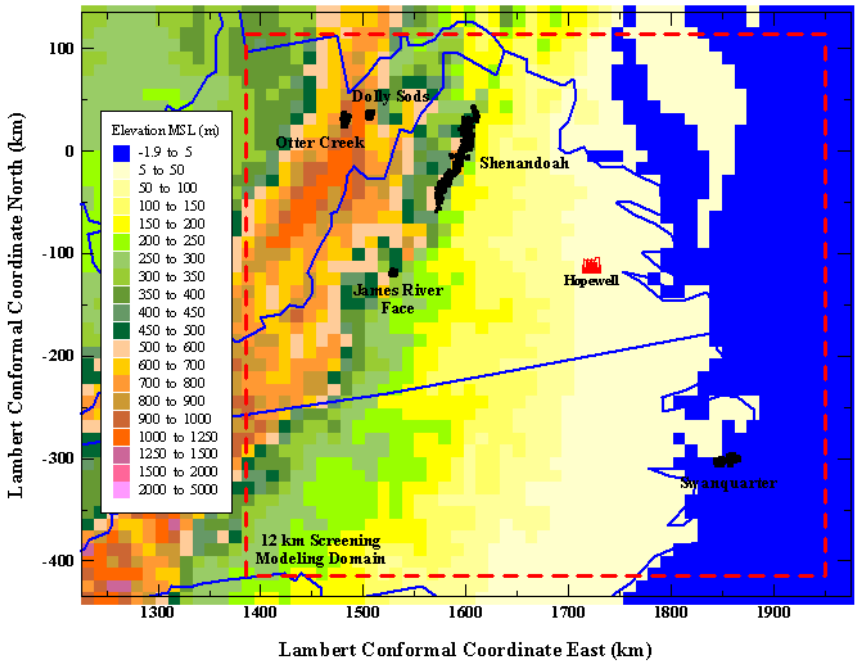


FIGURE 3-4. LAND USE AND COVER WITHIN THE 12-KM COMPUTATIONAL DOMAIN

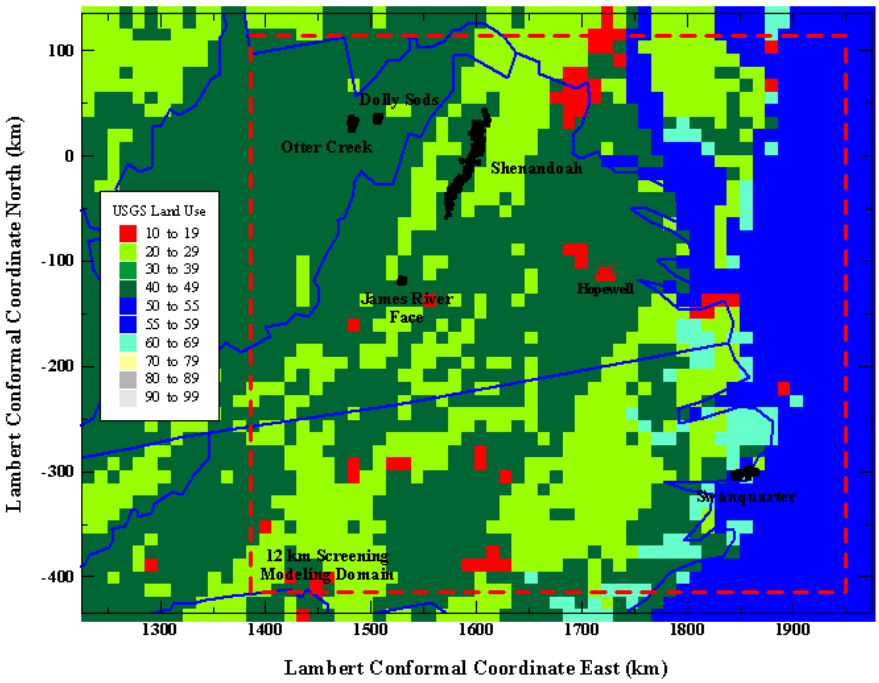


FIGURE 3-5. 4-KM REFINED ANALYSIS COMPUTATIONAL DOMAIN

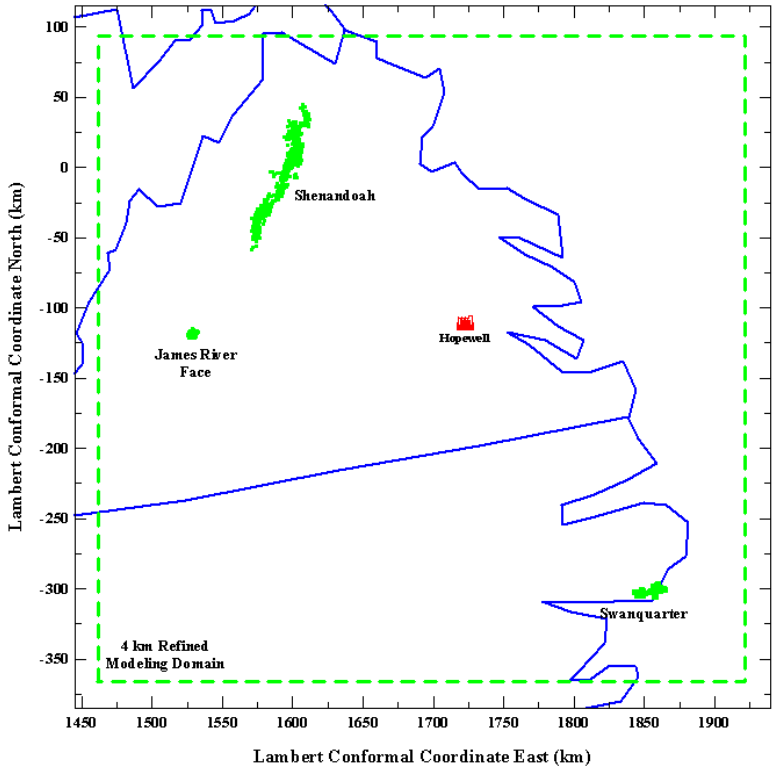


FIGURE 3-6. TERRAIN ELEVATIONS WITHIN THE 4-KM COMPUTATIONAL DOMAIN

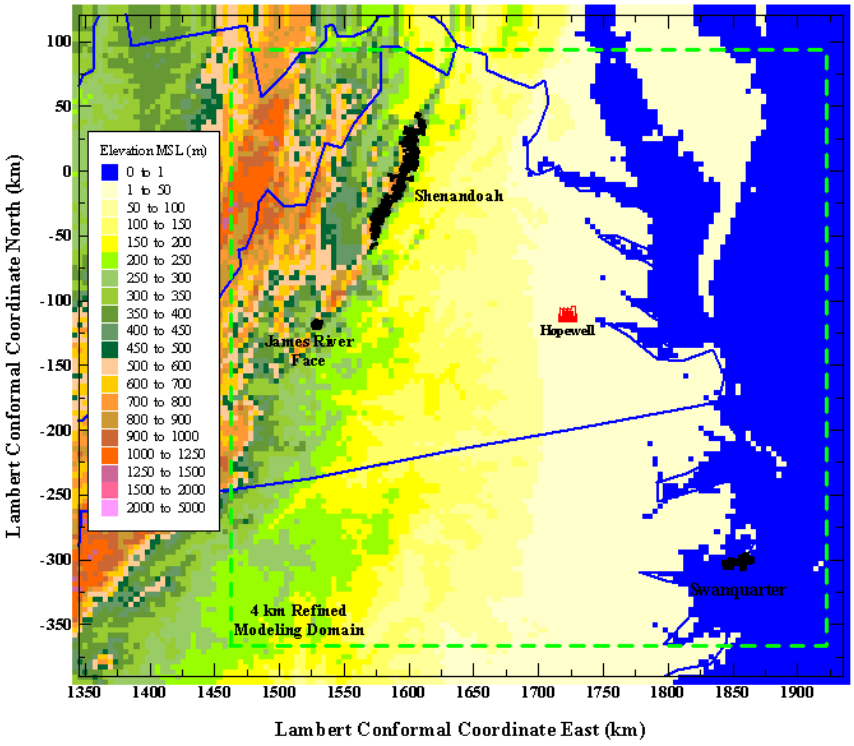


FIGURE 3-7. LAND USE AND COVER WITHIN THE 4-KM COMPUTATIONAL DOMAIN

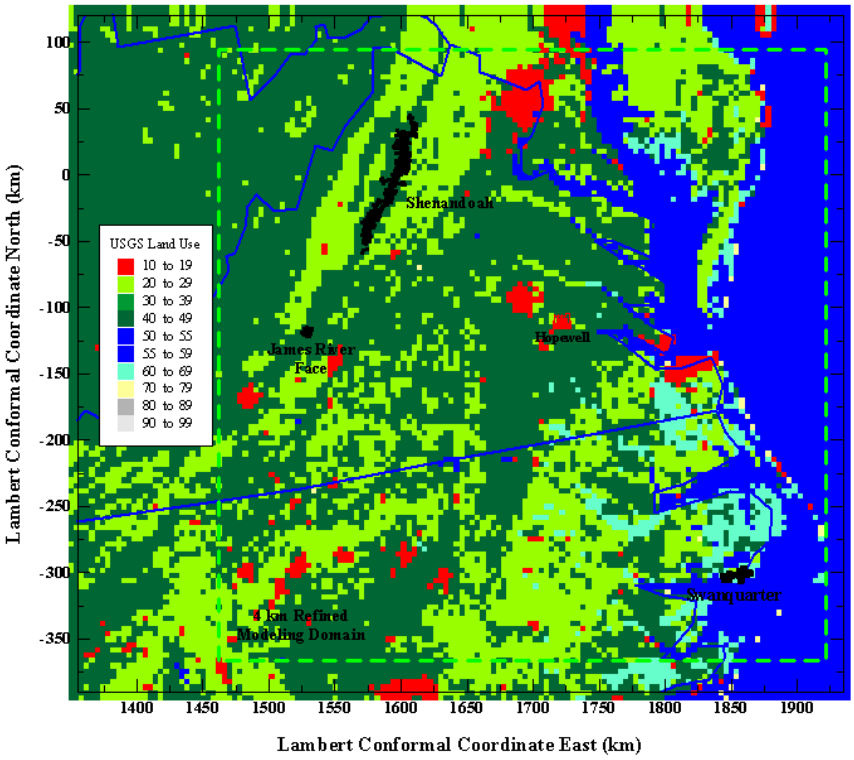


FIGURE 3-8. LOCATION AND ELEVATION OF RECEPTORS AT SHENANDOAH NP

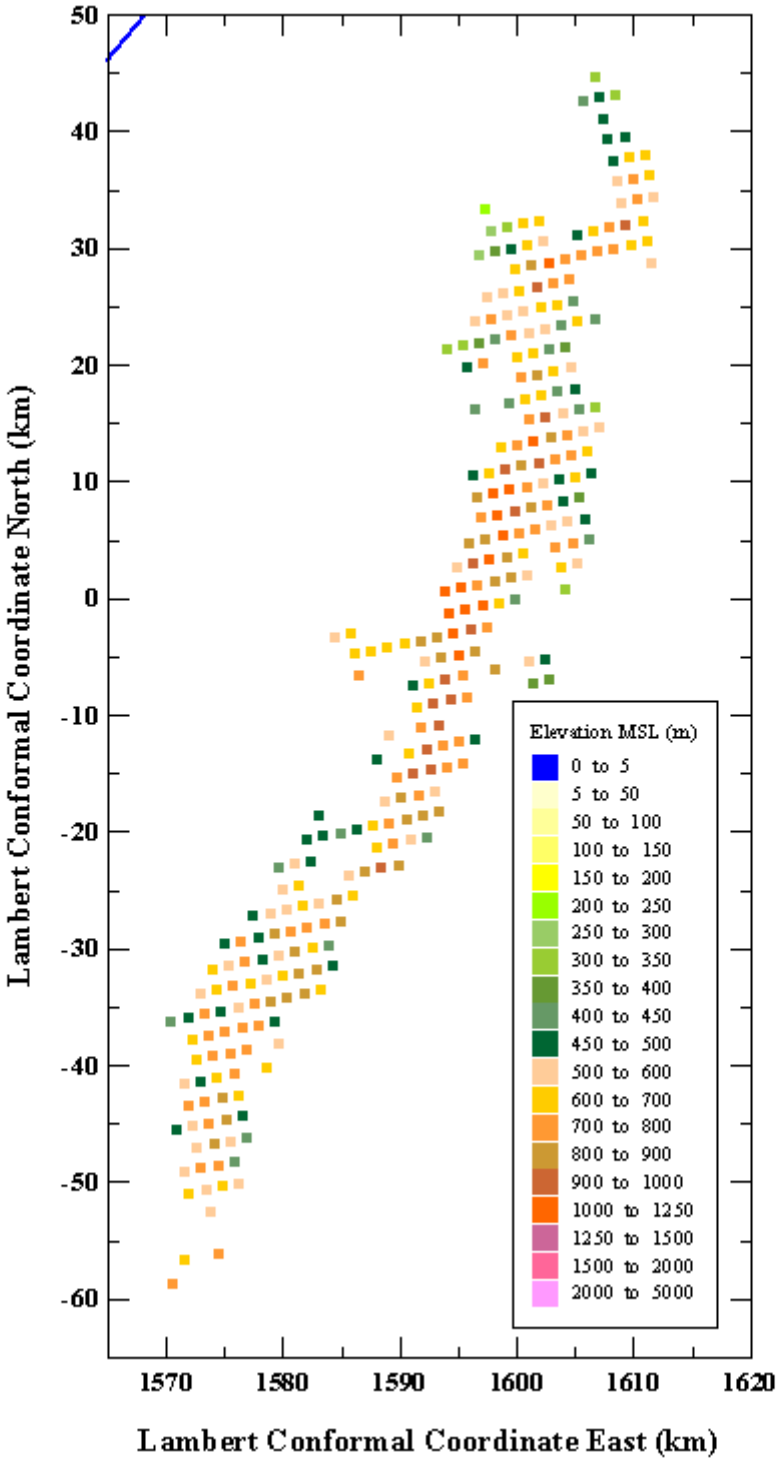


FIGURE 3-9. LOCATION AND ELEVATION OF RECEPTORS AT JAMES RIVER FACE WA

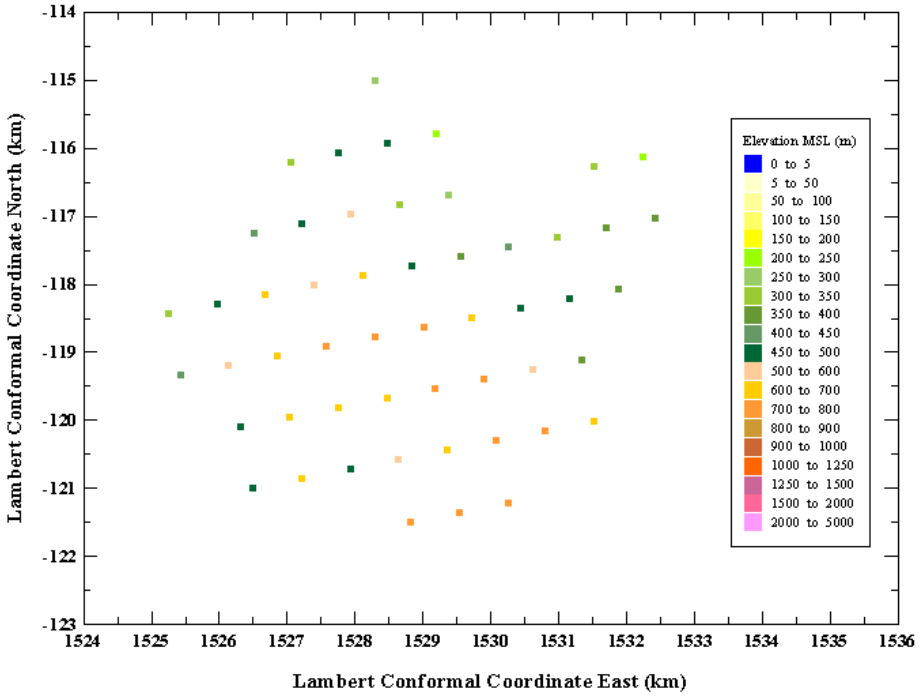


FIGURE 3-10. LOCATION AND ELEVATION OF RECEPTORS AT SWANQUARTER NWR

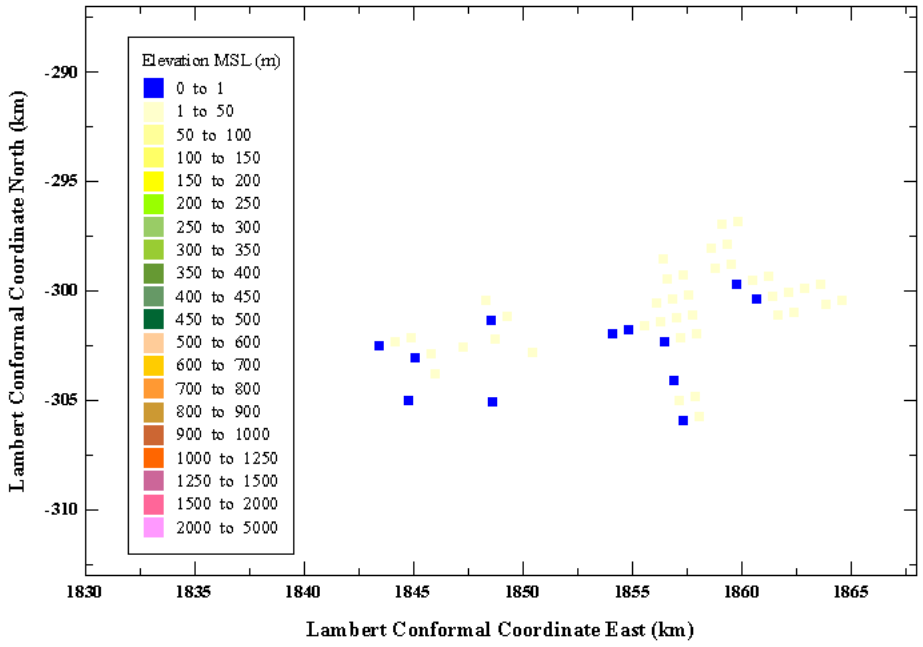


FIGURE 3-11. LOCATION AND ELEVATION OF RECEPTORS AT DOLLY SODS WA

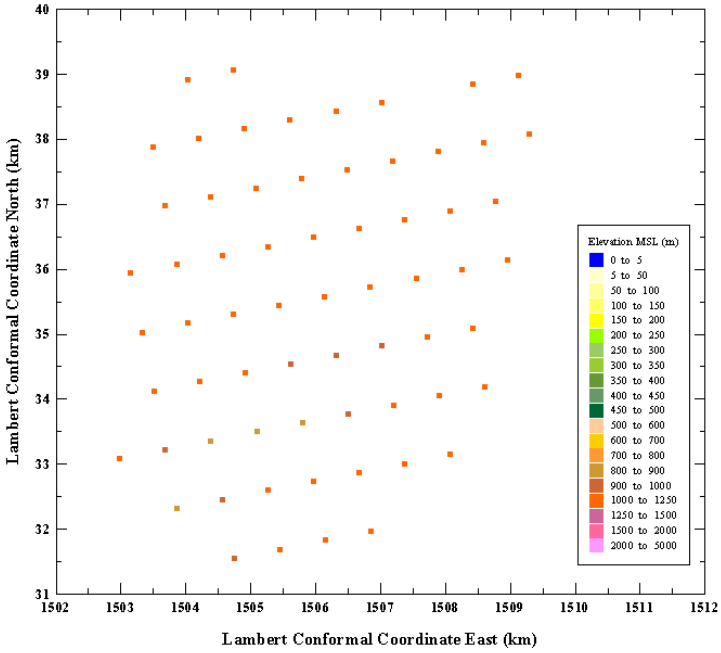
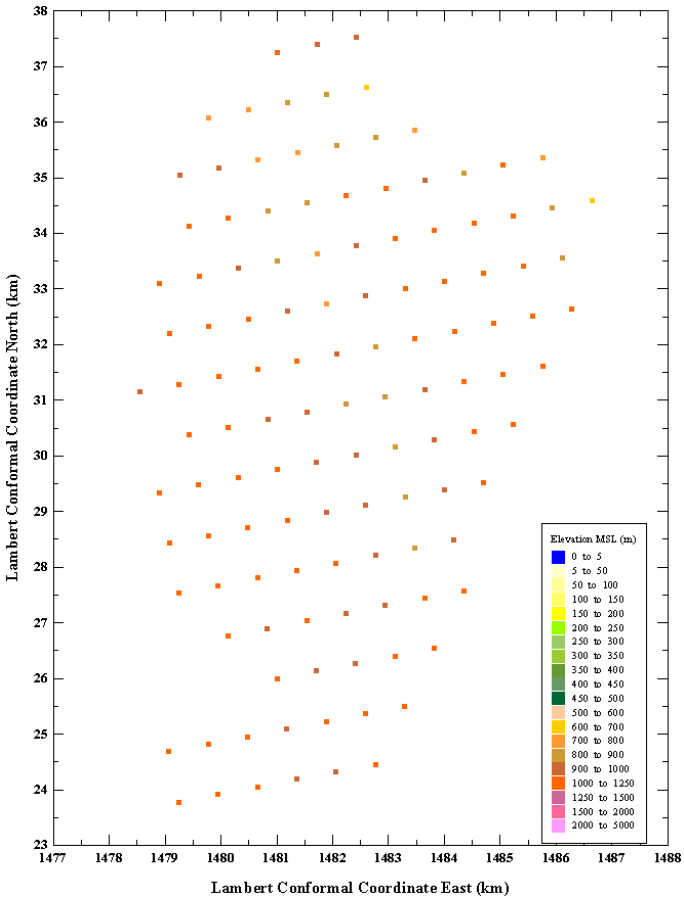


FIGURE 3-12. LOCATION AND ELEVATION OF RECEPTORS AT OTTER CREEK WA

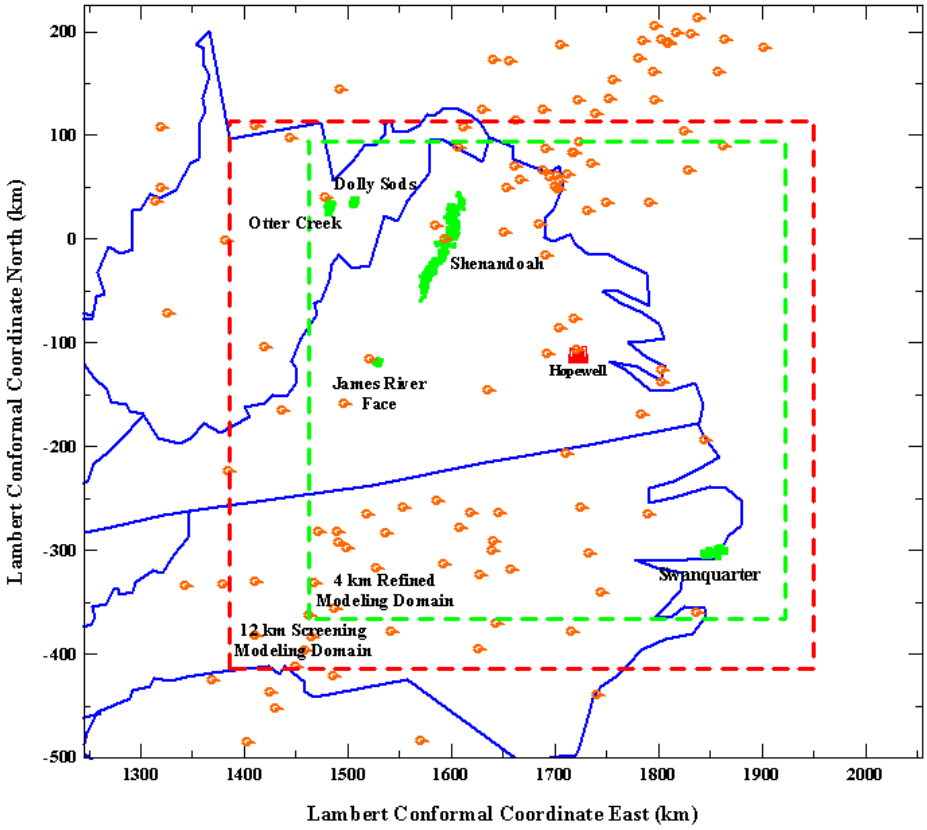


3.4.5 BACKGROUND OZONE AND AMMONIA CONCENTRATIONS

The CALPUFF model is capable of simulating linear chemical transformation effects by using pseudo-first-order chemical reaction mechanisms for the conversions of SO_2 to SO_4, and NO_X, which consists of nitrogen oxide (NO) and nitrogen dioxide (NO_2), to NO_3 and HNO_3. In this study, chemical transformations involving five species (SO_2, SO_4, NO_X, HNO_3, and NO_3) were modeled using the MESOPUFF II chemical transformation scheme. Ambient concentrations of NH_3 and ozone concentrations as represented in the model drive the MESOPUFF II chemical transformation simulation.

Both screening and refined analyses utilized observed ozone data for 2001 through 2003 from non-urban CASTNet and AIRS stations compiled by the VISTAS Technical Contractor for the regional domain. Honeywell extracted data from ozone observation stations in and near the modeling domains, as illustrated in Figure 3-13.

FIGURE 3-13. OZONE DATA STATIONS UTILIZED IN HONEYWELL'S BART APPLICABILITY ANALYSES



Monthly average ozone background values were computed based on daytime average ozone concentrations from the OZONE.DAT file (6am-6pm average ozone concentrations computed by month) of each year for substitution should all observations be missing for a particular hour of the dataset. Table 3-6 summarizes the monthly average ozone values computed for this substitution.

TABLE 3-6. MONTHLY AVERAGE SUBSTITUTE OZONE VALUES

Month	2001 Substitute Ozone Values (ppb)	2002 Substitute Ozone Values (ppb)	2003 Substitute Ozone Values (ppb)
January	25.43	27.58	25.61
February	29.08	32.93	26.48
March	36.80	37.42	37.40
April	46.73	45.03	45.68
May	51.17	48.62	40.05
June	51.12	54.14	46.85
July	45.95	52.99	44.39
August	50.62	51.58	43.88
September	41.30	41.09	36.82
October	38.38	28.07	34.19
November	33.21	24.53	29.17
December	24.94	24.25	24.45

In both the screening and refined analyses, a constant NH_3 background value of 0.5 ppb was input to the CALPUFF model in addition to the primary NH_3 emission rates from BART-eligible units. The initial *VISTAS BART Modeling Protocol* envisioned the use of modeled boundary conditions of NH_3 and sulfates in the refined analysis of chemical transformations involving these species and nitrates. However, VISTAS' Technical Analysis Workgroup has since concluded that modeled background and boundary conditions should not be utilized for BART modeling purposes because "EPA and FLM recommend that ALM approach using CMAQ concentration data (SO_X, NO_X, total NH_3) be reviewed by EPA Modeling Clearinghouse before being used in a regulatory application." Accordingly, such background data were not utilized in Honeywell's BART applicability modeling analyses. As described in the following section of this report, only refined analyses utilized the POSTUTIL postprocessing tool to re-partition the HNO_3 and NO_3 equilibrium distributions using only a constant 0.5 ppb NH_3 background level. Note that primary NH_3 emissions were also modeled from the Hopewell Plant and concentrations from the modeled emissions were included in the re-partitioning calculation as described in Section 3.5.1 of this report.

3.4.6 PUFF REPRESENTATION

As recommended by the *VISTAS BART Modeling Protocol*, the default integrated puff sampling methodology was enabled for both screening and refined CALPUFF analyses. In the screening analyses, the default setting to disable puff splitting algorithms was retained. Puff splitting was evaluated and found not to significantly change modeled impacts in this application despite the modest distance between the Hopewell Plant and the nearest Class I area, Shenandoah, at approximately 158 km distant. Therefore, the default model option to disable puff splitting was used in both screening and refined analyses.

3.4.7 QUALITY ASSURANCE OF CALPUFF ANALYSES

Sample CALPUFF input files for the screening and refined analyses are presented in Appendix A of this report and copies of all input and output files are included on the electronic media enclosed with this report. Comparison of the CALPUFF model inputs indicates that default values, as prescribed by IWAQM (Appendix B) and in the *VISTAS BART Modeling Protocol*, were used with the exception of the source-specific model options described in this report. Source parameters input for each BART-eligible emissions unit were verified with the information presented in Section 2 of this report. The location and elevations of Class I area receptors as illustrated in Figures 3-8 and 3-9 of this report were verified by comparison to NPS maps.

3.5 CALPOST POSTPROCESSING AND NATURAL BACKGROUND CONDITIONS FOR LIGHT EXTINCTION AND HAZE INDEX CALCULATIONS

Using the concentrations of visibility-affecting pollutants computed by CALPUFF, two postprocessors, POSTUTIL and CALPOST, were used to compute light extinction attributable to Honeywell's Hopewell Plant and the relevant metrics for the BART Applicability Analysis determination. The computation of light extinction attributable to the natural background and source was generally described in Section 1.1.2 of this report.

3.5.1 POSTUTIL PROCESSING

The first postprocessing step involves running POSTUTIL to calculate the concentrations of visibility-affecting species SO4, NO3, SOA, EC, PMF, and PMC, as described in Section 3.4.1 of this report. Specifically, POSTUTIL is used to group modeled species into visibility-affecting pollutant groups as originally shown as Table 3-5, reproduced here as Table 3-7. In screening analyses, POSTUTIL is only run once to achieve this pollutant grouping.

In refined analyses, POSTUTIL is run twice, initially to apply the ammonia limiting method (ALM) to re-partition the distribution of HNO_3 and NO_3 concentrations at each Class I area as a function of the temperature, relative humidity, and free NH_3 during each hour. ALM processing is not run by default, and therefore was not used in the screening analyses. ALM re-partitioning using the default NH_3 background level of 0.5 ppb was conducted in refined analyses. Because primary NH_3 emissions were modeled in addition to the background level, POSTUTIL option NH3TYP = 1, "NH3 Monthly averaged background (BCKNH3) … will be added to NH3 from [CALPUFF output] concentration files" was utilized.

TABLE 3-7. ASSIGNMENT OF MODELED PM SPECIES TO LIGHT EXTINCTION GROUPS IN POSTUTIL

Modeled Components	CALPOST Light Extinction Group	Extinction Coefficient (m^2/g)
PMC800 PMC425	PMC	0.6
PMF187 PMF112 PMF081 PMF056 PIC081 PIC056	SOIL	1
POC081 POC056	SOA	4
EC187 EC112 EC081 EC056	EC	10

3.5.2 CLASS I AREA-SPECIFIC NATURAL BACKGROUND CONDITIONS

The visibility goal of the Clean Air Act is both the remedying of existing visibility impairment and prevention of future visibility impairment. In its *BART Implementation Guidance*, U.S. EPA affirms that it interprets the goal to mean return atmospheric conditions to "natural visibility conditions." For the purposes of BART analyses, the U.S. EPA has determined that it "did not intend to limit States to the use of the 20% best visibility days…States may use 20% best visibility days or annual average" to assess BART applicability.[17] The July 18, 2006 revision to the *VISTAS BART Modeling Protocol* indicates that three options are available at the discretion of the state including Option (1) a single annual average natural background condition for each Class I area; Option (2), a single value representing the average haze index on the 20% estimated best visibility days at each Class I area; or, Option (3) monthly average natural background conditions computed from estimated components of visibility-affecting pollutants and monthly average relative humidity values specific to each Class I area. The Option (1) annual average natural background condition appears to be the preferred approach since analyses conducted by the VISTAS Technical Contractor for certain sources in the region used this method exclusively (for example, screening analyses of BART-eligible operations in Alabama).

For the five Class I areas within 300 km of the Hopewell Plant and potentially affected by Honeywell's operations, Table 3-8 summarizes the default natural background conditions as tabulated in Appendix B of U.S. EPA's *Guidance for Estimating Natural Visibility*

[17] U.S. EPA Memorandum from Mr. Joseph Paisie to Ms. Kay Prince, as Attachment A to a proposed settlement agreement between the Utility Air Regulatory Group and U.S. EPA, published at 71 Federal Register No. 84, pp. 25,838-25,840, May 2, 2006.

Conditions under the Regional Haze Rule that were used to calculate natural background conditions for the preceding three approaches.

TABLE 3-8. NATURAL BACKGROUND CONCENTRATIONS FOR CLASS I AREAS POTENTIALLY AFFECTED BY THE HOPEWELL PLANT

Class I Area	b_{ext} (Mm^{-1})	Annual Average Haze Index (dv)	Best Days Haze Index (dv)	Worst Days Haze Index (dv)
Shenandoah	20.98	7.41	3.57	11.25
James River Face	20.96	7.40	3.56	11.24
Swanquarter	20.91	7.38	3.54	11.22
Dolly Sods	21.13	7.48	3.64	11.32
Otter Creek	21.14	7.49	3.65	11.33

* As tabulated in Appendix B of U.S. EPA's *Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule* (2003).

To represent natural conditions in the absence of anthropogenic sources of sulfates and nitrates using Option (1), the monthly background extinction coefficient is expressed in terms of Rayleigh scattering and scattering due to soils (i.e., fine particles) based on the annual average haze index, and is calculated using the following equations.

$$b_{back} = 10 \exp\left(\frac{HI}{10}\right),$$

where *HI* is Haze Index expressed in units of deciviews (dv). Therefore, total b_{back} for the best days at the seven Class I areas within 300 km of the Hopewell Plant, including the default Rayleigh scattering coefficient is calculated as shown in the following equations.

$$b_{back} = 10 \exp\left(\frac{7.41}{10}\right) = 20.98\ Mm^{-1} = b_{ray} + b_{soil} = 10\ Mm^{-1} + b_{soil} \Rightarrow b_{soil} = 10.98\ Mm^{-1} \text{ for Shenandoah}$$

$$b_{back} = 10 \exp\left(\frac{7.40}{10}\right) = 20.96\ Mm^{-1} = b_{ray} + b_{soil} = 10\ Mm^{-1} + b_{soil} \Rightarrow b_{soil} = 10.96\ Mm^{-1} \text{ for James River Face}$$

$$b_{back} = 10 \exp\left(\frac{7.38}{10}\right) = 20.92\ Mm^{-1} = b_{ray} + b_{soil} = 10\ Mm^{-1} + b_{soil} \Rightarrow b_{soil} = 10.92\ Mm^{-1} \text{ for Swanquarter}$$

$$b_{back} = 10 \exp\left(\frac{7.48}{10}\right) = 21.13\ Mm^{-1} = b_{ray} + b_{soil} = 10\ Mm^{-1} + b_{soil} \Rightarrow b_{soil} = 11.13\ Mm^{-1} \text{ for Dolly Sods}$$

$$b_{back} = 10 \exp\left(\frac{7.49}{10}\right) = 21.14\ Mm^{-1} = b_{ray} + b_{soil} = 10\ Mm^{-1} + b_{soil} \Rightarrow b_{soil} = 11.14\ Mm^{-1} \text{ for Otter Creek}$$

The Option (3) approach of calculating the default natural background conditions using average natural concentrations of sulfate, nitrate, and particulate species for areas in the Eastern U.S. as tabulated in Table 2-1 of U.S. EPA's *Guidance for Estimating Natural*

Visibility Conditions under the Regional Haze Rule was reviewed but not used in this analysis because the natural background conditions are essentially equivalent to the VISTAS annual average background approach such that the alternative analysis was not warranted.

The effects of relative humidity to amplify the visibility impairment of hygroscopic sulfates and nitrates were characterized using CALPOST "Method 6," which computes Δb_{ext} using a *monthly average* relative humidity adjustment particular to each Class I area applied to background and modeled sulfate and nitrate. Table 3-10 summarizes the monthly average humidity values that were applied for the seven Class I areas considered in this analysis, as tabulated in Table A-3 of U.S. EPA's *Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule*.

TABLE 3-10. MONTHLY AVERAGE *f*(RH) FOR SELECTED CLASS I AREAS*

Class I Area	January	February	March	April	May	June	July	August	September	October	November	December
Shenandoah	3.1	2.8	2.8	2.5	3.1	3.4	3.5	3.9	3.9	3.2	3.0	3.1
James River Face	2.8	2.6	2.7	2.4	3.0	3.3	3.4	3.7	3.6	3.2	2.8	3.0
Swanquarter	2.9	2.7	2.6	2.5	2.9	3.2	3.4	3.5	3.4	3.1	2.8	2.9
Dolly Sods	3.0	2.8	2.8	2.6	3.1	3.4	3.5	3.9	3.9	3.3	3.0	3.1
Otter Creek	3.0	2.8	2.8	2.6	3.2	3.5	3.7	4.1	4.0	3.3	3.0	3.1

* As tabulated in Table A-3 of U.S. EPA's *Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule* (2003).

Natural background conditions for each Class I area were calculated using three visibility processing options, the data summarized in Tables 3-7, 3-8, 3-9, and 3-10, and the default IMPROVE light extinction formula, which is summarized in the following equation.

$$b_{ext,background}\left(Mm^{-1}\right) = b_{SO_4} + b_{NO_3} + b_{OC} + b_{Soil} + b_{Coarse} + b_{ap} + b_{Ray}$$

where,

$b_{SO_4} = 3[(NH_4)_2SO_4]f(RH)$ $[(NH_4)_2SO_4]$ denotes the ammonium sulfate concentration

$b_{NO_3} = 3[NH_4NO_3]f(RH)$ $[NH_4NO_3]$ denotes the ammonium nitrate concentration

$b_{OC} = 4[OC]$ $[OC]$ denotes the concentration of organic carbon

$b_{Soil} = 1[Soil]$ $[Soil]$ denotes the concentration of fine soils

$b_{Coarse} = 0.6[Coarse\ Mass]$ $[Coarse\ Mass]$ denotes the concentration of coarse dusts

$b_{ap} = 10[EC]$ $[EC]$ denotes the concentration of elemental carbon

b_{Ray} = Rayleigh Scattering $(10\ Mm^{-1}$ by default$)$ Rayleigh Scattering is scattering due to air molecules

$f(RH)$ = Relative Humidity Function

$[\ ]$ = Concentration in $\mu g/m^3$

3.5.3 VISIBILITY IMPACT CALCULATION

CALPOST is run separately for each Class I area to obtain the necessary visibility statistics for evaluating compliance with the BART visibility impairment thresholds. The inputs to CALPOST involve selection of the visibility method (i.e., Method 6) and entry of Class I area-specific data for computing background extinction and monthly relative humidity factors for hygroscopic aerosols as described in Section 3.5.2. CALPOST contains a receptor selection option that allow subsets of a receptor network modeling in CALPUFF to be selected for processing in a given CALPOST run. This selection specifies which receptors representing a single Class I area are selected for processing from a CALPUFF output file that may contain receptors from several Class I areas.

For screening analyses, the peak 24-hour average visibility impact for each year and Class I area was tabulated. The previously described Option (1) was used to quantify visibility impacts relative to annual average natural background conditions.

Refined analyses were analyzed by tabulating the 98th percentile 24-hour average visibility impact for each year and Class I area. Option (1) was used to quantify visibility impacts relative to annual average natural background conditions. As described in Section 3.2.1, the default interpretation of the 98th percentile (8th-highest day regardless of variability at each receptor) was evaluated for each year.

3.5.4 QUALITY ASSURANCE OF POSTPROCESSING ANALYSES

Quality assurance of postprocessing analyses was conducted by verifying the sequence of postprocessing (i.e., POSTUTIL, including ALM for refined analyses, followed by CALPOST) and that appropriate data files are referenced throughout the calculation sequence. The CALPOST inputs that were checked include the following:

- Visibility technique (Method 6)
- Monthly Class I-specific relative humidity factors for Method 6
- Background light extinction values calculated as appropriate using annual average natural background Option (1)
- Inclusion of all appropriate species from modeled sources (e.g., sulfate, nitrate, organics), coarse and fine particulate matter, and elemental carbon.
- Appropriate species names for coarse PM used
- Extinction efficiencies for each species
- Appropriate Rayleigh scattering term (10 Mm^{-1} for default modeling analyses)
- Screen to select appropriate Class I receptors for each CALPOST simulation.

Screening analyses of visibility impacts attributable to Honeywell's Hopewell Plant were conducted to determine whether the facility is subject to BART using a conservative assessment, and to focus the scope of refined analyses by demonstrating that visibility impairment is not likely to occur at more distant Class I areas. The screening analyses were conducted using the emissions data represented in Section 2 of this report, the screening CALMET and CALPUFF methods described in Sections 3.2, 3.3, and 3.4 of this report, and the postprocessing methods described in Section 3.5.

4.1 SCREENING ANALYSIS IMPACTS AT SHENANDOAH

Table 4-1 summarizes the modeled peak, 24-hour average visibility impacts at Shenandoah NP attributable to Honeywell's Hopewell Plant. This table summarizes the results calculated using Option (1) described in Section 3.5 for representing annual average natural background conditions. Results are presented in terms of visibility impact and the total number of days exceeding the 1.0 dv causation and 0.5 dv contribution thresholds, respectively.

TABLE 4-1. PEAK 24-HOUR AVERAGE VISIBILITY IMPACTS AT SHENANDOAH

Natural Background Method	2001 Δdv (> 1.0 dv, > 0.5 dv)	2002 Δdv (> 1.0 dv, > 0.5 dv)	2003 Δdv (> 1.0 dv, > 0.5 dv)
Annual Average	1.070 (1, 1)	0.901 (0, 2)	1.293 (1, 4)

The results presented in Table 4-1 indicate that refined analyses were necessary to evaluate visibility impacts at Shenandoah based on annual average natural background conditions.

4.2 SCREENING ANALYSIS IMPACTS AT JAMES RIVER FACE

Table 4-2 summarizes the modeled peak, 24-hour average visibility impacts at James River Face WA attributable to Honeywell's Hopewell Plant. This table summarizes the results calculated using Option (1) described in Section 3.5 for representing annual average natural background conditions. Results are presented in terms of visibility impact and the total number of days exceeding the 1.0 dv causation and 0.5 dv contribution thresholds, respectively.

TABLE 4-2. PEAK 24-HOUR AVERAGE VISIBILITY IMPACTS AT JAMES RIVER FACE

Natural Background Method	2001 Δdv (> 1.0 dv, > 0.5 dv)	2002 Δdv (> 1.0 dv, > 0.5 dv)	2003 Δdv (> 1.0 dv, > 0.5 dv)
Annual Average	0.395 (0, 0)	0.285 (0, 0)	0.656 (0, 2)

The results presented in Table 4-2 indicate that refined analyses were necessary to evaluate visibility impacts at James River Face based on annual average natural background conditions.

4.3 SCREENING ANALYSIS IMPACTS AT SWANQUARTER

Table 4-3 summarizes the modeled peak, 24-hour average visibility impacts at Swanquarter NWR attributable to Honeywell's Hopewell Plant. This table summarizes the results calculated using Option (1) described in Section 3.5 for representing annual average natural background conditions. Results are presented in terms of visibility impact and the total number of days exceeding the 1.0 dv causation and 0.5 dv contribution thresholds, respectively.

TABLE 4-3. PEAK 24-HOUR AVERAGE VISIBILITY IMPACTS AT SWANQUARTER

Natural Background Method	2001 Δdv (> 1.0 dv, > 0.5 dv)	2002 Δdv (> 1.0 dv, > 0.5 dv)	2003 Δdv (> 1.0 dv, > 0.5 dv)
Annual Average	0.353 (0, 0)	0.574 (0, 1)	0.440 (0, 0)

The results presented in Table 4-3 indicate that refined analyses were necessary to evaluate visibility impacts at Swanquarter based on annual average natural background conditions.

4.4 SCREENING ANALYSIS IMPACTS AT DOLLY SODS

Table 4-4 summarizes the modeled peak, 24-hour average visibility impacts at Dolly Sods WA attributable to Honeywell's Hopewell Plant. This table summarizes the results calculated using Option (1) described in Section 3.5 for representing annual average natural background conditions. Results are presented in terms of visibility impact and the total number of days exceeding the 1.0 dv causation and 0.5 dv contribution thresholds, respectively.

TABLE 4-4. PEAK 24-HOUR AVERAGE VISIBILITY IMPACTS AT DOLLY SODS

Natural Background Method	2001 Δdv (> 1.0 dv, > 0.5 dv)	2002 Δdv (> 1.0 dv, > 0.5 dv)	2003 Δdv (> 1.0 dv, > 0.5 dv)
Annual Average	0.211 (0, 0)	0.157 (0, 0)	0.147 (0, 0)

The results presented in Table 4-4 indicate that refined analyses were not necessary to evaluate visibility impacts at Dolly Sods based on annual average natural background conditions.

4.5 SCREENING ANALYSIS IMPACTS AT OTTER CREEK

Table 4-5 summarizes the modeled peak, 24-hour average visibility impacts at Otter Creek WA attributable to Honeywell's Hopewell Plant. This table summarizes the results calculated using Option (1) described in Section 3.5 for representing annual average natural background conditions. Results are presented in terms of visibility impact and the total number of days exceeding the 1.0 dv causation and 0.5 dv contribution thresholds, respectively.

TABLE 4-5. PEAK 24-HOUR AVERAGE VISIBILITY IMPACTS AT OTTER CREEK

Natural Background Method	2001 Δdv (> 1.0 dv, > 0.5 dv)	2002 Δdv (> 1.0 dv, > 0.5 dv)	2003 Δdv (> 1.0 dv, > 0.5 dv)
Annual Average	0.105 (0, 0)	0.110 (0, 0)	0.129 (0, 0)

The results presented in Table 4-5 indicate that refined analyses were not necessary to evaluate visibility impacts at Otter Creek based on annual average natural background conditions.

4.6 SUMMARY OF SCREENING ANALYSES

Because screening analyses of visibility impacts to Honeywell's Hopewell Plant indicated peak 24-hour average impacts above the 0.5 dv contribution threshold at Shenandoah, James River Face, and Swanquarter, refined modeling was required to evaluate Honeywell's contributions using refined modeling methods. Because screening impacts at Dolly Sods and Otter Creek did not exceed 0.5 dv, these areas were excluded from refined analyses since screening modeling demonstrated the Hopewell Plant does not contribute to visibility impairment at these areas.

Because the screening analysis results described in Section 4 of this report exceeded the 0.5 dv contribution threshold for impacts at three of the five Class I areas within 300 km of the Hopewell Plant, refined analyses were conducted using the emissions data represented in Section 2 of this report, the refined CALMET and CALPUFF methods described in Sections 3.2, 3.3, and 3.4 of this report, and the postprocessing methods described in Section 3.5. The following sections describe the analyses conducted using the default option to disable puff splitting algorithms.

5.1 REFINED ANALYSIS IMPACTS AT SHENANDOAH

Table 5-1 summarizes the top eight modeled 24-hour average visibility impacts of each data analysis year at Shenandoah attributable to Honeywell's Hopewell Plant using refined modeling methods and the default CALPUFF option to disable puff splitting. This table summarizes the results calculated using Option (1) described in Section 3.5 for representing annual average natural background conditions. The 98th percentile impact is represented conservatively as the 8th-high 24-hour average impact among the three years of analysis as taken from the standard CALPOST output. The total number of days exceeding the 1.0 dv causation and 0.5 dv contribution thresholds are also summarized.

TABLE 5-1. 24-HOUR AVERAGE VISIBILITY IMPACTS AT SHENANDOAH

Natural Background Method	Ranked 2001 Δdv	Ranked 2002 Δdv	Ranked 2003 Δdv	Maximum 8th-High Δdv (Total Days > 1.0 dv, > 0.5 dv)
Annual Average	0.682	0.560	1.230	0.344 (1, 8)
	0.665	0.528	0.960	
	0.489	0.496	0.777	
	0.422	0.324	0.701	
	0.377	0.313	0.475	
	0.316	0.300	0.368	
	0.302	0.286	0.357	
	0.301	0.277	0.344	

As an alternative representation of the 98th percentile, Table 5-2 summarizes a ranking of the top 25 daily average impacts over the three-year period modeled to quantify the 22nd-high impact over three years.

TABLE 5-2. RANKED 24-HOUR AVERAGE VISIBILITY IMPACTS AT SHENANDOAH OVER 2001 THROUGH 2003 DATA ANALYSIS PERIOD

Overall Rank	Annual Rank	Δdv
1	2003 #1	1.230
2	2003 #2	0.960
3	2003 #3	0.777
4	2003 #4	0.701
5	2001 #1	0.682
6	2001 #2	0.665
7	2002 #1	0.560
8	2002 #2	0.528
9	2002 #3	0.496
10	2001 #3	0.489
11	2003 #5	0.475
12	2001 #4	0.422
13	2001 #5	0.377
14	2003 #6	0.368
15	2003 #7	0.357
16	2003 #8	0.344
17	2002 #4	0.324
18	2001 #6	0.316
19	2002 #5	0.313
20	2001 #7	0.302
21	2001 #8	0.301
22	**2002 #6**	**0.300**
23	2001 #9	0.288
24	2002 #7	0.286
25	2003 #9	0.285

The results presented in Tables 5-1 and 5-2 indicate that Honeywell's Hopewell Plant does not contribute to visibility impairment at Shenandoah because the 98th percentile impact is below the 0.5 dv contribution threshold.

5.2 REFINED ANALYSIS IMPACTS AT JAMES RIVER FACE

Table 5-3 summarizes the top eight modeled 24-hour average visibility impacts of each data analysis year at James River Face attributable to Honeywell's Hopewell Plant using refined modeling methods and the default CALPUFF option to disable puff splitting. This table summarizes the results calculated using Option (1) described in Section 3.5 for representing annual average natural background conditions. The 98th percentile impact is represented conservatively as the 8th-high 24-hour average impact among the three years of analysis as taken from the standard CALPOST output. The total number of days exceeding the 1.0 dv causation and 0.5 dv contribution thresholds are also summarized.

TABLE 5-3. 24-HOUR AVERAGE VISIBILITY IMPACTS AT JAMES RIVER FACE

Natural Background Method	Ranked 2001 Δdv	Ranked 2002 Δdv	Ranked 2003 Δdv	Maximum 8th-High Δdv (Total Days > 1.0 dv, > 0.5 dv)
Annual Average	0.567	0.402	0.587	0.235 (0, 3)
	0.505	0.233	0.426	
	0.391	0.223	0.417	
	0.369	0.192	0.371	
	0.367	0.135	0.340	
	0.340	0.128	0.280	
	0.260	0.124	0.258	
	0.217	0.123	0.235	

As an alternative representation of the 98th percentile, Table 5-4 summarizes a ranking of the top 25 daily average impacts over the three-year period modeled to quantify the 22nd-high impact over three years.

TABLE 5-4. RANKED 24-HOUR AVERAGE VISIBILITY IMPACTS AT JAMES RIVER FACE OVER 2001 THROUGH 2003 DATA ANALYSIS PERIOD

Overall Rank	Annual Rank	Δdv
1	2003 #1	0.587
2	2001 #1	0.567
3	2001 #2	0.505
4	2003 #2	0.426
5	2003 #3	0.417
6	2002 #1	0.402
7	2001 #3	0.391
8	2003 #4	0.371
9	2001 #4	0.369
10	2001 #5	0.367
11	2001 #6	0.340
12	2003 #5	0.340
13	2003 #6	0.280
14	2001 #7	0.260
15	2003 #7	0.258
16	2003 #8	0.235
17	2002 #2	0.233
18	2003 #9	0.232
19	2002 #3	0.223
20	2001 #8	0.217
21	2001 #9	0.213
22	**2001 #10**	**0.210**
23	2001 #11	0.208
24	2002 #4	0.192
25	2001 #12	0.141

The results presented in Tables 5-3 and 5-4 indicate that Honeywell's Hopewell Plant does not contribute to visibility impairment at James River Face because the 98th percentile impact is below the 0.5 dv contribution threshold.

5.3 REFINED ANALYSIS IMPACTS AT SWANQUARTER

Table 5-5 summarizes the top eight modeled 24-hour average visibility impacts of each data analysis year at Swanquarter attributable to Honeywell's Hopewell Plant using refined modeling methods and the default CALPUFF option to disable puff splitting. This table summarizes the results calculated using Option (1) described in Section 3.5 for representing annual average natural background conditions. The 98th percentile impact is represented conservatively as the 8th-high 24-hour average impact among the three years of analysis as taken from the standard CALPOST output. The total number of days exceeding the 1.0 dv causation and 0.5 dv contribution thresholds are also summarized.

TABLE 5-5. 24-HOUR AVERAGE VISIBILITY IMPACTS AT SWANQUARTER

Natural Background Method	Ranked 2001 Δdv	Ranked 2002 Δdv	Ranked 2003 Δdv	Maximum 8th-High Δdv (Total Days > 1.0 dv, > 0.5 dv)
Annual Average	0.296	0.285	0.402	0.215 (0, 0)
	0.268	0.283	0.359	
	0.259	0.254	0.334	
	0.228	0.246	0.330	
	0.223	0.239	0.213	
	0.222	0.210	0.210	
	0.220	0.206	0.209	
	0.215	0.198	0.208	

As an alternative representation of the 98th percentile, Table 5-6 summarizes a ranking of the top 25 daily average impacts over the three-year period modeled to quantify the 22nd-high impact over three years.

TABLE 5-6. RANKED 24-HOUR AVERAGE VISIBILITY IMPACTS AT SWANQUARTER OVER 2001 THROUGH 2003 DATA ANALYSIS PERIOD

Overall Rank	Annual Rank	Δdv
1	2003 #1	0.402
2	2003 #2	0.359
3	2003 #3	0.334
4	2003 #4	0.330
5	2001 #1	0.296
6	2002 #1	0.285
7	2002 #2	0.283
8	2001 #2	0.268
9	2001 #3	0.259
10	2002 #3	0.254
11	2002 #4	0.246
12	2002 #5	0.239
13	2001 #4	0.228
14	2001 #5	0.223
15	2001 #6	0.222
16	2001 #7	0.220
17	2001 #8	0.215
18	2003 #5	0.213
19	2002 #6	0.210
20	2003 #6	0.210
21	2003 #7	0.209
22	**2003 #8**	**0.208**
23	2002 #7	0.206
24	2003 #9	0.205
25	2002 #8	0.198

The results presented in Tables 5-5 and 5-6 indicate that Honeywell's Hopewell Plant does not contribute to visibility impairment at Swanquarter because the 98th percentile impact is below the 0.5 dv contribution threshold.

5.4 SUMMARY OF REFINED ANALYSES

Refined CALPUFF modeling analyses were conducted to compute the 98th percentile 24-hour average visibility impacts at each Class I area as the maximum 8th-high impact of each of three data analysis years and the 22nd-high over the three data analysis years. Table 5-7 summarizes the computed impacts in comparison to the 0.5 dv contribution threshold.

TABLE 5-7. SUMMARY OF REFINED ANALYSIS 98TH PERCENTILE RESULTS

Class I Area	Maximum 8th-High Δdv of 3 Years	22nd-High Δdv over 3 Years
Shenandoah (158 km)	0.344	0.300
James River Face (190 km)	0.235	0.210
Swanquarter (227 km)	0.215	0.208

Table 5-7 summarizes the results of refined modeling analyses that demonstrate the 98th percentile 24-hour average visibility impact is less than the 0.5 dv contribution threshold at all Class I areas within 300 km. Therefore, Honeywell's Hopewell Plant is not considered subject to BART.

6. CONCLUSIONS

Using analysis methods prescribed by the U.S. EPA, VISTAS, and Virginia DEQ, Honeywell conducted BART Applicability Analyses of emissions of visibility-affecting pollutants from BART-eligible emission units at the Hopewell Plant. Screening and refined modeling analyses demonstrated that the 98th percentile 24-hour average visibility impact is less than the 0.5 dv contribution threshold relative to annual average natural background conditions at five Class I areas (Shenandoah, James River Face, Swanquarter, Dolly Sods, and Otter Creek) within 300 km of the Hopewell Plant. These results indicate that Honeywell's Hopewell Plant is not subject to BART because the BART-eligible source does not contribute to visibility impairment at any Class I areas.

APPENDIX A

SAMPLE CALPUFF, POSTUTIL, AND CALPOST INPUT FILES

CALPUFF BATCH PROCESSING FILE

12-KM SCREENING ANALYSES

```
REM HONEYWELL HOPEWELL VIRGINIA 12 KM SCREENING
REM BART APPLICABILITY ANALYSIS
REM RAG 9.7.06

REM RUN 2001
CALL CALPUFFL.EXE HONYWLVA01.INP
CALL POSTUTILL.EXE HONYWLVAUT01.INP
CALL CALPOSTL.EXE HONYWLVAVANDS01.INP
CALL CALPOSTL.EXE HONYWLVAVANJR01.INP
CALL CALPOSTL.EXE HONYWLVAVANOC01.INP
CALL CALPOSTL.EXE HONYWLVAVANSH01.INP
CALL CALPOSTL.EXE HONYWLVAVANSQ01.INP


REM RUN 2002
CALL CALPUFFL.EXE HONYWLVA02.INP
CALL POSTUTILL.EXE HONYWLVAUT02.INP
CALL CALPOSTL.EXE HONYWLVAVANDS02.INP
CALL CALPOSTL.EXE HONYWLVAVANJR02.INP
CALL CALPOSTL.EXE HONYWLVAVANOC02.INP
CALL CALPOSTL.EXE HONYWLVAVANSH02.INP
CALL CALPOSTL.EXE HONYWLVAVANSQ02.INP


REM RUN 2003
CALL CALPUFFL.EXE HONYWLVA03.INP
CALL CALPOSTL.EXE HONYWLVAVANDS03.INP
CALL CALPOSTL.EXE HONYWLVAVANJR03.INP
CALL CALPOSTL.EXE HONYWLVAVANOC03.INP
CALL CALPOSTL.EXE HONYWLVAVANSH03.INP
CALL CALPOSTL.EXE HONYWLVAVANSQ03.INP

PAUSE
EXIT
```

SAMPLE CALPUFF INPUT FILE

HONYWLVA02.INP
12-KM SCREENING ANALYSIS YEAR 2002

```
HONEYWELL HOPEWELL VIRGINIA
BART APPLICABILITY ANALYSIS 12 KM SCREENING
JAMES RIVER FACE/SHENANDOAH/DOLLY SODS/OTTER CREEK/SWANQUARTER ANALYSES
---------------- Run title (3 lines) ----------------------------------------

                    CALPUFF MODEL CONTROL FILE
                    --------------------------

--------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names

--------------
Default Name  Type          File Name
------------  ----          ---------
CALMET.DAT    input    * METDAT =              *
    or
ISCMET.DAT    input    * ISCDAT =              *
    or
PLMMET.DAT    input    * PLMDAT =              *
    or
PROFILE.DAT   input    * PRFDAT =              *
SURFACE.DAT   input    * SFCDAT =              *
RESTARTB.DAT  input    * RSTARTB=              *
--------------------------------------------------------------------------------
CALPUFF.LST   output   ! PUFLST =S:\BART\HONYWLVA\12KM\HONYWLVA02.LST  !
CONC.DAT      output   ! CONDAT =S:\BART\HONYWLVA\12KM\HONYWLVA02.CON  !
DFLX.DAT      output   ! DFDAT  =S:\BART\HONYWLVA\12KM\HONYWLVA02.DRY  !
WFLX.DAT      output   ! WFDAT  =S:\BART\HONYWLVA\12KM\HONYWLVA02.WET  !
VISB.DAT      output   ! VISDAT =S:\BART\HONYWLVA\12KM\HONYWLVA02.VIS  !
RESTARTE.DAT  output   ! RSTARTE=S:\BART\HONYWLVA\12KM\HONYWLVA02.RES  !
--------------------------------------------------------------------------------
Emission Files
--------------
PTEMARB.DAT   input    * PTDAT  =              *
VOLEMARB.DAT  input    * VOLDAT =              *
BAEMARB.DAT   input    * ARDAT  =              *
LNEMARB.DAT   input    * LNDAT  =              *
--------------------------------------------------------------------------------
Other Files
-----------
OZONE.DAT     input    ! OZDAT  =S:\BART\HONYWLVA\OZONE\OZONEX02.DAT    !
VD.DAT        input    * VDDAT  =              *
CHEM.DAT      input    * CHEMDAT=              *
H2O2.DAT      input    * H2O2DAT=              *
HILL.DAT      input    * HILDAT=               *
HILLRCT.DAT   input    * RCTDAT=               *
COASTLN.DAT   input    * CSTDAT=               *
FLUXBDY.DAT   input    * BDYDAT=               *
```

```
BCON.DAT      input    * BCNDAT=               *
DEBUG.DAT     output   * DEBUG =               *
MASSFLX.DAT   output   * FLXDAT=               *
MASSBAL.DAT   output   * BALDAT=               *
FOG.DAT       output   * FOGDAT=               *
------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 70 characters in length


Provision for multiple input files
----------------------------------

     Number of CALMET.DAT files for run (NMETDAT)
                                    Default: 1       ! NMETDAT =   12   !

     Number of PTEMARB.DAT files for run (NPTDAT)
                                    Default: 0       ! NPTDAT =  0  !

     Number of BAEMARB.DAT files for run (NARDAT)
                                    Default: 0       ! NARDAT =  0  !

     Number of VOLEMARB.DAT files for run (NVOLDAT)
                                    Default: 0       ! NVOLDAT =  0  !

!END!

-------------
Subgroup (0a)
-------------

  The following CALMET.DAT filenames are processed in sequence if NMETDAT>1

Default Name  Type          File Name
------------  ----          ---------
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-01R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-02R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-03R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-04R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-05R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-06R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-07R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-08R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-09R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-10R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-11R.DAT     !  !END!
```

```
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-12R.DAT     !  !END!


--------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

    Option to run all periods found
    in the met. file     (METRUN)   Default: 0       ! METRUN =   0  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in met. file

     Starting date:   Year (IBYR) -- No default       ! IBYR =  2002 !
     (used only if   Month (IBMO) -- No default       ! IBMO =  1    !
      METRUN = 0)      Day (IBDY) -- No default       ! IBDY =  1    !
                      Hour (IBHR) -- No default       ! IBHR =  1    !

     Base time zone        (XBTZ) -- No default       ! XBTZ = 5.0   !
        PST = 8., MST = 7.
        CST = 6., EST = 5.

     Length of run (hours) (IRLG) -- No default       ! IRLG =  8760 !

     Number of chemical species (NSPEC)
                                  Default: 5       ! NSPEC =  20  !

     Number of chemical species
     to be emitted  (NSE)         Default: 3       ! NSE =  19  !

     Flag to stop run after
     SETUP phase (ITEST)          Default: 2       ! ITEST =  2   !
     (Used to allow checking
     of the model inputs, files, etc.)
           ITEST = 1 - STOPS program after SETUP phase
           ITEST = 2 - Continues with execution of program
                       after SETUP

     Restart Configuration:

        Control flag (MRESTART)      Default: 0       ! MRESTART =  0   !

           0 = Do not read or write a restart file
           1 = Read a restart file at the beginning of
               the run
           2 = Write a restart file during run
           3 = Read a restart file at beginning of run
               and write a restart file during run
```

```
        Number of periods in Restart
        output cycle (NRESPD)        Default: 0       ! NRESPD =  0   !

           0 = File written only at last period
          >0 = File updated every NRESPD periods

     Meteorological Data Format (METFM)
                                     Default: 1       ! METFM =  1   !

           METFM = 1 - CALMET binary file (CALMET.MET)
           METFM = 2 - ISC ASCII file (ISCMET.MET)
           METFM = 3 - AUSPLUME ASCII file (PLMMET.MET)
           METFM = 4 - CTDM plus tower file (PROFILE.DAT) and
                       surface parameters file (SURFACE.DAT)
           METFM = 5 - AERMET tower file (PROFILE.DAT) and
                       surface parameters file (SURFACE.DAT)

     Meteorological Profile Data Format (MPRFFM)
            (used only for METFM = 1, 2, 3)
                                     Default: 1       ! MPRFFM =  1   !

           MPRFFM = 1 - CTDM plus tower file (PROFILE.DAT)
           MPRFFM = 2 - AERMET tower file (PROFILE.DAT)

     PG sigma-y is adjusted by the factor (AVET/PGTIME)**0.2
     Averaging Time (minutes) (AVET)
                                     Default: 60.0    ! AVET = 60. !
     PG Averaging Time (minutes) (PGTIME)
                                     Default: 60.0    ! PGTIME = 60. !


!END!


------------------------------------------------------------------------------

INPUT GROUP: 2 -- Technical options
--------------


     Vertical distribution used in the
     near field (MGAUSS)                  Default: 1     ! MGAUSS =  1   !
        0 = uniform
        1 = Gaussian

     Terrain adjustment method
     (MCTADJ)                             Default: 3     ! MCTADJ =  3   !
        0 = no adjustment
```

```
        1 = ISC-type of terrain adjustment
        2 = simple, CALPUFF-type of terrain
            adjustment
        3 = partial plume path adjustment

     Subgrid-scale complex terrain
     flag (MCTSG)                          Default: 0     ! MCTSG =  0   !
        0 = not modeled
        1 = modeled

     Near-field puffs modeled as
     elongated slugs? (MSLUG)              Default: 0     ! MSLUG =  0   !
        0 = no
        1 = yes (slug model used)

     Transitional plume rise modeled?
     (MTRANS)                              Default: 1     ! MTRANS =  1   !
        0 = no  (i.e., final rise only)
        1 = yes (i.e., transitional rise computed)

     Stack tip downwash? (MTIP)            Default: 1     ! MTIP =  1  !
        0 = no  (i.e., no stack tip downwash)
        1 = yes (i.e., use stack tip downwash)

     Method used to simulate building
     downwash? (MBDW)                      Default: 1     ! MBDW =   1  !
        1 = ISC method
        2 = PRIME method

     Vertical wind shear modeled above
     stack top? (MSHEAR)                   Default: 0     ! MSHEAR =  0  !
        0 = no  (i.e., vertical wind shear not modeled)
        1 = yes (i.e., vertical wind shear modeled)

     Puff splitting allowed? (MSPLIT)      Default: 0     ! MSPLIT =  0  !
        0 = no (i.e., puffs not split)
        1 = yes (i.e., puffs are split)

     Chemical mechanism flag (MCHEM)       Default: 1     ! MCHEM =  1   !
        0 = chemical transformation not
            modeled
        1 = transformation rates computed
            internally (MESOPUFF II scheme)
        2 = user-specified transformation
            rates used
        3 = transformation rates computed
            internally (RIVAD/ARM3 scheme)
        4 = secondary organic aerosol formation
            computed (MESOPUFF II scheme for OH)
```

```
Aqueous phase transformation flag (MAQCHEM)
(Used only if MCHEM = 1, or 3)        Default: 0     ! MAQCHEM =  0   !
   0 = aqueous phase transformation
       not modeled
   1 = transformation rates adjusted
       for aqueous phase reactions

Wet removal modeled ? (MWET)          Default: 1     ! MWET =  1   !
   0 = no
   1 = yes

Dry deposition modeled ? (MDRY)       Default: 1     ! MDRY =  1   !
   0 = no
   1 = yes
   (dry deposition method specified
    for each species in Input Group 3)


Gravitational settling (plume tilt)
modeled ? (MTILT)                     Default: 0     ! MTILT =  0   !
   0 = no
   1 = yes
   (puff center falls at the gravitational
    settling velocity for 1 particle species)

Restrictions:
    - MDRY  = 1
    - NSPEC = 1  (must be particle species as well)
    - sg    = 0  GEOMETRIC STANDARD DEVIATION in Group 8 is
                 set to zero for a single particle diameter

Method used to compute dispersion
coefficients (MDISP)                  Default: 3     ! MDISP =  3   !

   1 = dispersion coefficients computed from measured values
       of turbulence, sigma v, sigma w
   2 = dispersion coefficients from internally calculated
       sigma v, sigma w using micrometeorological variables
       (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
       the ISCST multi-segment approximation) and MP coefficients in
       urban areas
   4 = same as 3 except PG coefficients computed using
       the MESOPUFF II eqns.
   5 = CTDM sigmas used for stable and neutral conditions.
       For unstable conditions, sigmas are computed as in
       MDISP = 3, described above.  MDISP = 5 assumes that
       measured values are read
```

```
Sigma-v/sigma-theta, sigma-w measurements used? (MTURBVW)
(Used only if MDISP = 1 or 5)         Default: 3     ! MTURBVW =  3  !
   1 = use sigma-v or sigma-theta measurements
       from PROFILE.DAT to compute sigma-y
       (valid for METFM = 1, 2, 3, 4, 5)
   2 = use sigma-w measurements
       from PROFILE.DAT to compute sigma-z
       (valid for METFM = 1, 2, 3, 4, 5)
   3 = use both sigma-(v/theta) and sigma-w
       from PROFILE.DAT to compute sigma-y and sigma-z
       (valid for METFM = 1, 2, 3, 4, 5)
   4 = use sigma-theta measurements
       from PLMMET.DAT to compute sigma-y
       (valid only if METFM = 3)

Back-up method used to compute dispersion
when measured turbulence data are
missing (MDISP2)                      Default: 3     ! MDISP2 =  3  !
(used only if MDISP = 1 or 5)
   2 = dispersion coefficients from internally calculated
       sigma v, sigma w using micrometeorological variables
       (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
       the ISCST multi-segment approximation) and MP coefficients in
       urban areas
   4 = same as 3 except PG coefficients computed using
       the MESOPUFF II eqns.

[DIAGNOSTIC FEATURE]
Method used for Lagrangian timescale for Sigma-y
(used only if MDISP=1,2 or MDISP2=1,2)
(MTAULY)                              Default: 0     ! MTAULY =  0  !
   0 = Draxler default 617.284 (s)
   1 = Computed as Lag. Length / (.75 q) -- after SCIPUFF
  10 < Direct user input (s)             -- e.g., 306.9


[DIAGNOSTIC FEATURE]
Method used for Advective-Decay timescale for Turbulence
(used only if MDISP=2 or MDISP2=2)
(MTAUADV)                             Default: 0     ! MTAUADV =  0  !
   0 = No turbulence advection
   1 = Computed (OPTION NOT IMPLEMENTED)
  10 < Direct user input (s)   -- e.g., 300


Method used to compute turbulence sigma-v &
sigma-w using micrometeorological variables
```

```
(Used only if MDISP = 2 or MDISP2 = 2)
(MCTURB)                              Default: 1     ! MCTURB =  1  !
   1 = Standard CALPUFF subroutines
   2 = AERMOD subroutines

PG sigma-y,z adj. for roughness?      Default: 0     ! MROUGH =  0  !
(MROUGH)
   0 = no
   1 = yes

Partial plume penetration of          Default: 1     ! MPARTL =  1  !
elevated inversion?
(MPARTL)
   0 = no
   1 = yes

Strength of temperature inversion     Default: 0     ! MTINV =  0  !
provided in PROFILE.DAT extended records?
(MTINV)
   0 = no (computed from measured/default gradients)
   1 = yes

PDF used for dispersion under convective conditions?
                                      Default: 0     ! MPDF =  0  !
(MPDF)
   0 = no
   1 = yes

Sub-Grid TIBL module used for shore line?
                                      Default: 0     ! MSGTIBL = 0  !
(MSGTIBL)
   0 = no
   1 = yes

Boundary conditions (concentration) modeled?
                                      Default: 0     ! MBCON = 0  !
(MBCON)
   0 = no
   1 = yes, using formatted BCON.DAT file
   2 = yes, using unformatted CONC.DAT file


Analyses of fogging and icing impacts due to emissions from
arrays of mechanically-forced cooling towers can be performed
using CALPUFF in conjunction with a cooling tower emissions
processor (CTEMISS) and its associated postprocessors.  Hourly
emissions of water vapor and temperature from each cooling tower
cell are computed for the current cell configuration and ambient
conditions by CTEMISS. CALPUFF models the dispersion of these
```

```
     emissions and provides cloud information in a specialized format
     for further analysis. Output to FOG.DAT is provided in either
     'plume mode' or 'receptor mode' format.

     Configure for FOG Model output?
                                          Default: 0     ! MFOG =  0   !
     (MFOG)
        0 = no
        1 = yes  - report results in PLUME Mode format
        2 = yes  - report results in RECEPTOR Mode format


     Test options specified to see if
     they conform to regulatory
     values? (MREG)                       Default: 1     ! MREG =  1   !

        0 = NO checks are made
        1 = Technical options must conform to USEPA
            Long Range Transport (LRT) guidance
                       METFM    1 or 2
                       AVET     60. (min)
                       PGTIME   60. (min)
                       MGAUSS   1
                       MCTADJ   3
                       MTRANS   1
                       MTIP     1
                       MCHEM    1 or 3 (if modeling SOx, NOx)
                       MWET     1
                       MDRY     1
                       MDISP    2 or 3
                       MPDF     0 if MDISP=3
                                1 if MDISP=2
                       MROUGH   0
                       MPARTL   1
                       SYTDEP   550. (m)
                       MHFTSZ   0


!END!


------------------------------------------------------------------------------

INPUT GROUP: 3a, 3b -- Species list
-------------------

------------
Subgroup (3a)
------------
```

The following species are modeled:

```
! CSPEC =          SO2 !         !END!
! CSPEC =          SO4 !         !END!
! CSPEC =          NOX !         !END!
! CSPEC =         HNO3 !         !END!
! CSPEC =          NO3 !         !END!
! CSPEC =       POC081 !         !END!
! CSPEC =       POC056 !         !END!
! CSPEC =       PIC081 !         !END!
! CSPEC =       PIC056 !         !END!
! CSPEC =       PMC800 !         !END!
! CSPEC =       PMC425 !         !END!
! CSPEC =       PMF187 !         !END!
! CSPEC =       PMF112 !         !END!
! CSPEC =       PMF081 !         !END!
! CSPEC =       PMF056 !         !END!
! CSPEC =        EC187 !         !END!
! CSPEC =        EC112 !         !END!
! CSPEC =        EC081 !         !END!
! CSPEC =        EC056 !         !END!
! CSPEC =          NH3 !         !END!
```

SPECIES NAME (Limit: 12 Characters in length)	MODELED (0=NO, 1=YES)	EMITTED (0=NO, 1=YES)	Dry DEPOSITED (0=NO, 1=COMPUTED-GAS 2=COMPUTED-PARTICLE 3=USER-SPECIFIED)	OUTPUT GROUP NUMBER (0=NONE, 1=1st CGRUP, 2=2nd CGRUP, 3= etc.)
SO2	1	1	1	0
SO4	1	1	2	0
NOX	1	1	1	0
HNO3	1	0	1	0
NO3	1	1	2	0
POC081	1	1	2	0
POC056	1	1	2	0
PIC081	1	1	2	0
PIC056	1	1	2	0
PMC800	1	1	2	0
PMC425	1	1	2	0
PMF187	1	1	2	0
PMF112	1	1	2	0
PMF081	1	1	2	0
PMF056	1	1	2	0
EC187	1	1	2	0
EC112	1	1	2	0
EC081	1	1	2	0

```
!        EC056  =         1,              1,           2,                0   !
!          NH3  =         1,              1,           1,                0   !

!END!

-------------
Subgroup (3b)
-------------
  The following names are used for Species-Groups in which results
  for certain species are combined (added) prior to output.  The
  CGRUP name will be used as the species name in output files.
  Use this feature to model specific particle-size distributions
  by treating each size-range as a separate species.
  Order must be consistent with 3(a) above.



--------------------------------------------------------------------------------


INPUT GROUP: 4 -- Map Projection and Grid control parameters
--------------

     Projection for all (X,Y):
     -------------------------

     Map projection
     (PMAP)                     Default: UTM    ! PMAP = LCC  !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
          PS :  Polar Stereographic
          EM :  Equatorial Mercator
        LAZA :  Lambert Azimuthal Equal Area

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                    Default=0.0     ! FEAST  = 0.000  !
     (FNORTH)                   Default=0.0     ! FNORTH = 0.000  !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                   No Default      ! IUTMZN =  0   !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)                   Default: N      ! UTMHEM = N  !
         N   :  Northern hemisphere projection
```

```
        S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
     (RLAT0)                    No Default      ! RLAT0 = 40N  !
     (RLON0)                    No Default      ! RLON0 = 97W  !

         TTM :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         LCC :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         PS  :  RLON0 identifies central (grid N/S) meridian of projection
                RLAT0 selected for convenience
         EM  :  RLON0 identifies central meridian of projection
                RLAT0 is REPLACED by 0.0N (Equator)
         LAZA:  RLON0 identifies longitude of tangent-point of mapping plane
                RLAT0 identifies latitude of tangent-point of mapping plane

     Matching parallel(s) of latitude (decimal degrees) for projection
     (Used only if PMAP= LCC or PS)
     (XLAT1)                    No Default      ! XLAT1 = 33N  !
     (XLAT2)                    No Default      ! XLAT2 = 45N  !

         LCC :  Projection cone slices through Earth's surface at XLAT1 and XLAT2
         PS  :  Projection plane slices through Earth at XLAT1
                (XLAT2 is not used)

     ----------
     Note:  Latitudes and longitudes should be positive, and include a
            letter N,S,E, or W indicating north or south latitude, and
            east or west longitude.  For example,
            35.9  N Latitude  =  35.9N
            118.7 E Longitude = 118.7E


     Datum-region
     ------------

     The Datum-Region for the coordinates is identified by a character
     string.  Many mapping products currently available use the model of the
     Earth known as the World Geodetic System 1984 (WGS-84).  Other local
     models may be in use, and their selection in CALMET will make its output
     consistent with local mapping products.  The list of Datum-Regions with
     official transformation parameters is provided by the National Imagery and
     Mapping Agency (NIMA).

     NIMA Datum - Regions(Examples)
     ------------------------------------------------------------------------
     WGS-84    WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)
```

```
     NAS-C     NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)
     NAR-C     NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)
     NWS-84    NWS 6370KM Radius, Sphere
     ESR-S     ESRI REFERENCE 6371KM Radius, Sphere

     Datum-region for output coordinates
     (DATUM)                    Default: WGS-84    ! DATUM = NWS-84  !


METEOROLOGICAL Grid:

     Rectangular grid defined for projection PMAP,
     with X the Easting and Y the Northing coordinate

           No. X grid cells (NX)      No default     ! NX =  160   !
           No. Y grid cells (NY)      No default     ! NY =  172   !
       No. vertical layers (NZ)       No default     ! NZ =  10    !

         Grid spacing (DGRIDKM)       No default     ! DGRIDKM = 12. !
                                      Units: km

              Cell face heights
                  (ZFACE(nz+1))       No defaults
                                      Units: m
  ! ZFACE = 0., 20., 40., 80., 160., 320., 640., 1200., 2000., 3000., 4000. !

           Reference Coordinates
          of SOUTHWEST corner of
               grid cell(1, 1):

           X coordinate (XORIGKM)     No default     ! XORIGKM =   137.973  !
           Y coordinate (YORIGKM)     No default     ! YORIGKM = -1625.974  !
                                     Units: km


COMPUTATIONAL Grid:

     The computational grid is identical to or a subset of the MET. grid.
     The lower left (LL) corner of the computational grid is at grid point
     (IBCOMP, JBCOMP) of the MET. grid.  The upper right (UR) corner of the
     computational grid is at grid point (IECOMP, JECOMP) of the MET. grid.
     The grid spacing of the computational grid is the same as the MET. grid.

        X index of LL corner (IBCOMP)      No default     ! IBCOMP =  105  !
                  (1 <= IBCOMP <= NX)

        Y index of LL corner (JBCOMP)      No default     ! JBCOMP =  102  !
                  (1 <= JBCOMP <= NY)
```

```
        X index of UR corner (IECOMP)      No default     ! IECOMP =  151  !
                  (1 <= IECOMP <= NX)

        Y index of UR corner (JECOMP)      No default     ! JECOMP =  145  !
                  (1 <= JECOMP <= NY)


SAMPLING Grid (GRIDDED RECEPTORS):

     The lower left (LL) corner of the sampling grid is at grid point
     (IBSAMP, JBSAMP) of the MET. grid.  The upper right (UR) corner of the
     sampling grid is at grid point (IESAMP, JESAMP) of the MET. grid.
     The sampling grid must be identical to or a subset of the computational
     grid.  It may be a nested grid inside the computational grid.
     The grid spacing of the sampling grid is DGRIDKM/MESHDN.

        Logical flag indicating if gridded
        receptors are used (LSAMP)         Default: T     ! LSAMP = F !
        (T=yes, F=no)

        X index of LL corner (IBSAMP)      No default     ! IBSAMP =  1   !
         (IBCOMP <= IBSAMP <= IECOMP)

        Y index of LL corner (JBSAMP)      No default     ! JBSAMP =  1   !
         (JBCOMP <= JBSAMP <= JECOMP)


        X index of UR corner (IESAMP)      No default     ! IESAMP =  1   !
         (IBCOMP <= IESAMP <= IECOMP)

        Y index of UR corner (JESAMP)      No default     ! JESAMP =  1   !
         (JBCOMP <= JESAMP <= JECOMP)


       Nesting factor of the sampling
        grid (MESHDN)                      Default: 1     ! MESHDN =  1  !
        (MESHDN is an integer >= 1)

!END!


------------------------------------------------------------------------------


INPUT GROUP: 5 -- Output Options
--------------
                                          *                          *
```

```
     FILE                          DEFAULT VALUE             VALUE THIS RUN
     ----                          -------------             --------------

   Concentrations (ICON)               1                    !  ICON =  1   !
   Dry Fluxes (IDRY)                   1                    !  IDRY =  1   !
   Wet Fluxes (IWET)                   1                    !  IWET =  1   !
   Relative Humidity (IVIS)            1                    !  IVIS =  1   !
    (relative humidity file is
     required for visibility
     analysis)
   Use data compression option in output file?
   (LCOMPRS)                          Default: T            ! LCOMPRS = T !

   *
    0 = Do not create file, 1 = create file


    DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

       Mass flux across specified boundaries
       for selected species reported hourly?
       (IMFLX)                        Default: 0            ! IMFLX =  0  !
         0 = no
         1 = yes (FLUXBDY.DAT and MASSFLX.DAT filenames
                  are specified in Input Group 0)

       Mass balance for each species
       reported hourly?
       (IMBAL)                        Default: 0            ! IMBAL =  0  !
         0 = no
         1 = yes (MASSBAL.DAT filename is
              specified in Input Group 0)


    LINE PRINTER OUTPUT OPTIONS:

       Print concentrations (ICPRT)   Default: 0            ! ICPRT =  0   !
       Print dry fluxes (IDPRT)       Default: 0            ! IDPRT =  0   !
       Print wet fluxes (IWPRT)       Default: 0            ! IWPRT =  0   !
       (0 = Do not print, 1 = Print)

       Concentration print interval
       (ICFRQ) in hours               Default: 1            ! ICFRQ =  1   !
       Dry flux print interval
       (IDFRQ) in hours               Default: 1            ! IDFRQ =  1   !
       Wet flux print interval
       (IWFRQ) in hours               Default: 1            ! IWFRQ =  1   !

       Units for Line Printer Output
```

```
       (IPRTU)                          Default: 1         ! IPRTU =  3   !
                        for              for
                   Concentration    Deposition
              1 =       g/m**3          g/m**2/s
              2 =      mg/m**3         mg/m**2/s
              3 =      ug/m**3         ug/m**2/s
              4 =      ng/m**3         ng/m**2/s
              5 =     Odour Units

       Messages tracking progress of run
       written to the screen ?
       (IMESG)                          Default: 2         ! IMESG =  2   !
         0 = no
         1 = yes (advection step, puff ID)
         2 = yes (YYYYJJJHH, # old puffs, # emitted puffs)


     SPECIES (or GROUP for combined species) LIST FOR OUTPUT OPTIONS

                   ---- CONCENTRATIONS ----   ------ DRY FLUXES ------   ------ WET FLUXES ------   -- MASS
                   FLUX --
    SPECIES
    /GROUP         PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   SAVED ON
    DISK?
    -------        ------------------------   ------------------------   ------------------------
    ---------------
!          SO2 =     0,           1,           0,           1,           0,           1,           0   !
!          SO4 =     0,           1,           0,           1,           0,           1,           0   !
!          NOX =     0,           1,           0,           1,           0,           1,           0   !
!         HNO3 =     0,           1,           0,           1,           0,           1,           0   !
!          NO3 =     0,           1,           0,           1,           0,           1,           0   !
!       POC081 =     0,           1,           0,           0,           0,           0,           0   !
!       POC056 =     0,           1,           0,           0,           0,           0,           0   !
!       PIC081 =     0,           1,           0,           0,           0,           0,           0   !
!       PIC056 =     0,           1,           0,           0,           0,           0,           0   !
!       PMC800 =     0,           1,           0,           0,           0,           0,           0   !
!       PMC425 =     0,           1,           0,           0,           0,           0,           0   !
!       PMF187 =     0,           1,           0,           0,           0,           0,           0   !
!       PMF112 =     0,           1,           0,           0,           0,           0,           0   !
!       PMF081 =     0,           1,           0,           0,           0,           0,           0   !
!       PMF056 =     0,           1,           0,           0,           0,           0,           0   !
!        EC187 =     0,           1,           0,           0,           0,           0,           0   !
!        EC112 =     0,           1,           0,           0,           0,           0,           0   !
!        EC081 =     0,           1,           0,           0,           0,           0,           0   !
!        EC056 =     0,           1,           0,           0,           0,           0,           0   !
!          NH3 =     0,           1,           0,           0,           0,           0,           0   !

     OPTIONS FOR PRINTING "DEBUG" QUANTITIES (much output)
```

```
       Logical for debug output
       (LDEBUG)                                  Default: F     ! LDEBUG = F !

       First puff to track
       (IPFDEB)                                  Default: 1     ! IPFDEB =  1  !

       Number of puffs to track
       (NPFDEB)                                  Default: 1     ! NPFDEB =  10  !

       Met. period to start output
       (NN1)                                     Default: 1     ! NN1 =  10   !

       Met. period to end output
       (NN2)                                     Default: 10    ! NN2 =  10  !

!END!


--------------------------------------------------------------------------------


INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs
-------------------------

---------------
Subgroup (6a)
---------------
       Number of terrain features (NHILL)        Default: 0     ! NHILL =  0   !

       Number of special complex terrain
       receptors  (NCTREC)                       Default: 0     ! NCTREC =  0   !

       Terrain and CTSG Receptor data for
       CTSG hills input in CTDM format ?
       (MHILL)                                   No Default     ! MHILL =  0   !
       1 = Hill and Receptor data created
           by CTDM processors & read from
           HILL.DAT and HILLRCT.DAT files
       2 = Hill data created by OPTHILL &
           input below in Subgroup (6b);
           Receptor data in Subgroup (6c)

       Factor to convert horizontal dimensions   Default: 1.0   ! XHILL2M = 0. !
       to meters (MHILL=1)

       Factor to convert vertical dimensions     Default: 1.0   ! ZHILL2M = 0. !
       to meters (MHILL=1)

       X-origin of CTDM system relative to       No Default     ! XCTDMKM = 0.0E00 !
```

```
       CALPUFF coordinate system, in Kilometers (MHILL=1)

       Y-origin of CTDM system relative to      No Default     ! YCTDMKM = 0.0E00 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

! END !

---------------
Subgroup (6b)
---------------

                      1 **
     HILL information


HILL           XC         YC       THETAH   ZGRID   RELIEF    EXPO 1    EXPO 2   SCALE 1    SCALE 2    AMAX1
AMAX2
 NO.          (km)       (km)      (deg.)    (m)      (m)       (m)       (m)       (m)        (m)       (m)
 (m)
----          ----       ----      ------   -----   ------    ------    ------   -------    -------    -----
-----

---------------
Subgroup (6c)
---------------

    COMPLEX TERRAIN RECEPTOR INFORMATION

                     XRCT         YRCT         ZRCT          XHH
                     (km)         (km)          (m)
                    ------       -----       ------         ----


-------------------
1
     Description of Complex Terrain Variables:
          XC, YC  = Coordinates of center of hill
          THETAH  = Orientation of major axis of hill (clockwise from
                    North)
          ZGRID   = Height of the  0  of the grid above mean sea
                    level
          RELIEF  = Height of the crest of the hill above the grid elevation
          EXPO 1  = Hill-shape exponent for the major axis
          EXPO 2  = Hill-shape exponent for the major axis
          SCALE 1 = Horizontal length scale along the major axis
          SCALE 2 = Horizontal length scale along the minor axis
          AMAX    = Maximum allowed axis length for the major axis
          BMAX    = Maximum allowed axis length for the major axis
```

```
          XRCT, YRCT = Coordinates of the complex terrain receptors
          ZRCT    = Height of the ground (MSL) at the complex terrain
                    Receptor
          XHH     = Hill number associated with each complex terrain receptor
                    (NOTE: MUST BE ENTERED AS A REAL NUMBER)

   **
     NOTE: DATA for each hill and CTSG receptor are treated as a separate
           input subgroup and therefore must end with an input group terminator.

-------------------------------------------------------------------------------


INPUT GROUP: 7 -- Chemical parameters for dry deposition of gases
--------------

      SPECIES     DIFFUSIVITY      ALPHA STAR      REACTIVITY    MESOPHYLL RESISTANCE     HENRY'S LAW
      COEFFICIENT
       NAME         (cm**2/s)                                          (s/cm)
       (dimensionless)
      -------     -----------      ----------      ----------    --------------------
      ------------------------

!          SO2 =     0.1509,         1000.,            8.,               0.,                 0.04 !
!          NOX =     0.1656,            1.,            8.,               5.,                  3.5 !
!         HNO3 =     0.1628,            1.,           18.,               0.,           0.00000008 !
!          NH3 =     0.2340,           0.2,            4.,               0.,             0.000359 !

!END!


-------------------------------------------------------------------------------


INPUT GROUP: 8 -- Size parameters for dry deposition of particles
--------------

     For SINGLE SPECIES, the mean and standard deviation are used to
     compute a deposition velocity for NINT (see group 9) size-ranges,
     and these are then averaged to obtain a mean deposition velocity.

     For GROUPED SPECIES, the size distribution should be explicitly
     specified (by the 'species' in the group), and the standard deviation
     for each should be entered as 0.  The model will then use the
     deposition velocity for the stated mean diameter.

      SPECIES      GEOMETRIC MASS MEAN        GEOMETRIC STANDARD
       NAME             DIAMETER                   DEVIATION
                         (microns)                  (microns)
```

```
      -------      -------------------        ------------------
!          SO4 =          0.48,                      2.   !
!          NO3 =          0.48,                      2.   !
!       POC081 =        0.8125,                      0.   !
!       POC056 =        0.5625,                      0.   !
!       PIC081 =        0.8125,                      0.   !
!       PIC056 =        0.5625,                      0.   !
!       PMC800 =            8.,                      0.   !
!       PMC425 =          4.25,                      0.   !
!       PMF187 =         1.875,                      0.   !
!       PMF112 =         1.125,                      0.   !
!       PMF081 =        0.8125,                      0.   !
!       PMF056 =        0.5625,                      0.   !
!        EC187 =         1.875,                      0.   !
!        EC112 =         1.125,                      0.   !
!        EC081 =        0.8125,                      0.   !
!        EC056 =        0.5625,                      0.   !

!END!


--------------------------------------------------------------------------------


INPUT GROUP: 9 -- Miscellaneous dry deposition parameters
--------------

     Reference cuticle resistance (s/cm)
     (RCUTR)                          Default: 30    !  RCUTR = 30.0 !
     Reference ground resistance  (s/cm)
     (RGR)                            Default: 10    !    RGR = 10.0 !
     Reference pollutant reactivity
     (REACTR)                         Default: 8     ! REACTR = 8.0 !

     Number of particle-size intervals used to
     evaluate effective particle deposition velocity
     (NINT)                           Default: 9     !   NINT =  9  !

     Vegetation state in unirrigated areas
     (IVEG)                           Default: 1     !   IVEG =  1   !
        IVEG=1 for active and unstressed vegetation
        IVEG=2 for active and stressed vegetation
        IVEG=3 for inactive vegetation

!END!


--------------------------------------------------------------------------------
```

INPUT GROUP: 10 -- Wet Deposition Parameters

Scavenging Coefficient -- Units: (sec)**(-1)

Pollutant	Liquid Precip.	Frozen Precip.
SO2 =	3.0E-05,	0.0E00
SO4 =	1.0E-04,	3.0E-05
NOX =	0.0E00,	0.0E00
HNO3 =	6.0E-05,	0.0E00
NO3 =	1.0E-04,	3.0E-05
POC081 =	1.0E-04,	3.0E-05
POC056 =	1.0E-04,	3.0E-05
PIC081 =	1.0E-04,	3.0E-05
PIC056 =	1.0E-04,	3.0E-05
PMC800 =	1.0E-04,	3.0E-05
PMC425 =	1.0E-04,	3.0E-05
PMF187 =	1.0E-04,	3.0E-05
PMF112 =	1.0E-04,	3.0E-05
PMF081 =	1.0E-04,	3.0E-05
PMF056 =	1.0E-04,	3.0E-05
EC187 =	1.0E-04,	3.0E-05
EC112 =	1.0E-04,	3.0E-05
EC081 =	1.0E-04,	3.0E-05
EC056 =	1.0E-04,	3.0E-05
NH3 =	8.0E-05,	0.0E00

!END!

INPUT GROUP: 11 -- Chemistry Parameters

Ozone data input option (MOZ) Default: 1 ! MOZ = 1 !
(Used only if MCHEM = 1, 3, or 4)
0 = use a monthly background ozone value
1 = read hourly ozone concentrations from
the OZONE.DAT data file

Monthly ozone concentrations
(Used only if MCHEM = 1, 3, or 4 and
MOZ = 0 or MOZ = 1 and all hourly O3 data missing)
(BCKO3) in ppb Default: 12*80.

```
 ! BCKO3      =  27.58, 32.93, 37.42, 45.03, 48.62, 54.14, 52.99, 51.58, 41.09, 28.07, 24.53, 24.25 !

     Monthly ammonia concentrations
     (Used only if MCHEM = 1, or 3)
     (BCKNH3) in ppb                   Default: 12*10.
     !  BCKNH3 = 0.50, 0.50, 0.50, 0.50, 0.50, 0.50, 0.50, 0.50, 0.50, 0.50, 0.50, 0.50 !

     Nighttime SO2 loss rate (RNITE1)
     in percent/hour                   Default: 0.2          ! RNITE1 = 0.2 !

     Nighttime NOx loss rate (RNITE2)
     in percent/hour                   Default: 2.0          ! RNITE2 = 2.0 !

     Nighttime HNO3 formation rate (RNITE3)
     in percent/hour                   Default: 2.0          ! RNITE3 = 2.0 !

     H2O2 data input option (MH2O2)    Default: 1            ! MH2O2 =  1   !
     (Used only if MAQCHEM = 1)
        0 = use a monthly background H2O2 value
        1 = read hourly H2O2 concentrations from
            the H2O2.DAT data file

     Monthly H2O2 concentrations
     (Used only if MQACHEM = 1 and
      MH2O2 = 0 or MH2O2 = 1 and all hourly H2O2 data missing)
     (BCKH2O2) in ppb                  Default: 12*1.
     !  BCKH2O2 = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00 !


 --- Data for SECONDARY ORGANIC AEROSOL (SOA) Option
     (used only if MCHEM = 4)

     The SOA module uses monthly values of:
          Fine particulate concentration in ug/m^3 (BCKPMF)
          Organic fraction of fine particulate     (OFRAC)
          VOC / NOX ratio (after reaction)         (VCNX)
     to characterize the air mass when computing
     the formation of SOA from VOC emissions.
     Typical values for several distinct air mass types are:

        Month    1    2    3    4    5    6    7    8    9   10   11   12
                Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec

     Clean Continental
        BCKPMF   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.
        OFRAC  .15  .15  .20  .20  .20  .20  .20  .20  .20  .20  .20  .15
        VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.

     Clean Marine (surface)
```

```
        BCKPMF  .5   .5   .5   .5   .5   .5   .5   .5   .5   .5   .5   .5
        OFRAC  .25  .25  .30  .30  .30  .30  .30  .30  .30  .30  .30  .25
        VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.

     Urban - low biogenic (controls present)
        BCKPMF  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.
        OFRAC  .20  .20  .25  .25  .25  .25  .25  .25  .20  .20  .20  .20
        VCNX     4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.

     Urban - high biogenic (controls present)
        BCKPMF  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.
        OFRAC  .25  .25  .30  .30  .30  .55  .55  .55  .35  .35  .35  .25
        VCNX    15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.

     Regional Plume
        BCKPMF  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.
        OFRAC  .20  .20  .25  .35  .25  .40  .40  .40  .30  .30  .30  .20
        VCNX    15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.

     Urban - no controls present
        BCKPMF 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
        OFRAC  .30  .30  .35  .35  .35  .55  .55  .55  .35  .35  .35  .30
        VCNX     2.   2.   2.   2.   2.   2.   2.   2.   2.   2.   2.   2.

     Default: Clean Continental
     !  BCKPMF = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00 !
     !  OFRAC  = 0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.15 !
     !  VCNX   = 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00 !


!END!


---------------------------------------------------------------------------


INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters
---------------

     Horizontal size of puff (m) beyond which
     time-dependent dispersion equations (Heffter)
     are used to determine sigma-y and
     sigma-z (SYTDEP)                          Default: 550.    ! SYTDEP = 5.5E02 !

     Switch for using Heffter equation for sigma z
     as above (0 = Not use Heffter; 1 = use Heffter
     (MHFTSZ)                                  Default: 0       ! MHFTSZ =  0    !

     Stability class used to determine plume
```

```
     growth rates for puffs above the boundary
     layer (JSUP)                              Default: 5      ! JSUP =  5   !

     Vertical dispersion constant for stable
     conditions (k1 in Eqn. 2.7-3)  (CONK1)    Default: 0.01   ! CONK1 = .01 !

     Vertical dispersion constant for neutral/
     unstable conditions (k2 in Eqn. 2.7-4)
     (CONK2)                                   Default: 0.1    ! CONK2 = .1 !

     Factor for determining Transition-point from
     Schulman-Scire to Huber-Snyder Building Downwash
     scheme (SS used for Hs < Hb + TBD * HL)
     (TBD)                                     Default: 0.5    ! TBD = .5 !
        TBD < 0   ==> always use Huber-Snyder
        TBD = 1.5 ==> always use Schulman-Scire
        TBD = 0.5 ==> ISC Transition-point

     Range of land use categories for which
     urban dispersion is assumed
     (IURB1, IURB2)                            Default: 10     ! IURB1 =  10  !
                                                        19     ! IURB2 =  19  !

     Site characterization parameters for single-point Met data files ---------
     (needed for METFM = 2,3,4,5)

        Land use category for modeling domain
        (ILANDUIN)                             Default: 20     ! ILANDUIN =  20  !

        Roughness length (m) for modeling domain
        (Z0IN)                                 Default: 0.25   ! Z0IN = .25 !

        Leaf area index for modeling domain
        (XLAIIN)                               Default: 3.0    ! XLAIIN = 3.0 !

        Elevation above sea level (m)
        (ELEVIN)                               Default: 0.0    ! ELEVIN = .0 !

        Latitude (degrees) for met location
        (XLATIN)                               Default: -999.  ! XLATIN = -999.0 !

        Longitude (degrees) for met location
        (XLONIN)                               Default: -999.  ! XLONIN = -999.0 !

     Specialized information for interpreting single-point Met data files -----

        Anemometer height (m) (Used only if METFM = 2,3)
        (ANEMHT)                               Default: 10.    ! ANEMHT = 10.0 !
```

```
   Form of lateral turbulance data in PROFILE.DAT file
   (Used only if METFM = 4,5 or MTURBVW = 1 or 3)
   (ISIGMAV)                                Default: 1      ! ISIGMAV =  1  !
       0 = read sigma-theta
       1 = read sigma-v

   Choice of mixing heights (Used only if METFM = 4)
   (IMIXCTDM)                               Default: 0      ! IMIXCTDM =  0  !
       0 = read PREDICTED mixing heights
       1 = read OBSERVED mixing heights

Maximum length of a slug (met. grid units)
(XMXLEN)                                    Default: 1.0    ! XMXLEN = 1.0 !

Maximum travel distance of a puff/slug (in
grid units) during one sampling step
(XSAMLEN)                                   Default: 1.0    ! XSAMLEN = 1.0 !

Maximum Number of slugs/puffs release from
one source during one time step
(MXNEW)                                     Default: 99     ! MXNEW =  99   !

Maximum Number of sampling steps for
one puff/slug during one time step
(MXSAM)                                     Default: 99     ! MXSAM =  99   !

Number of iterations used when computing
the transport wind for a sampling step
that includes gradual rise (for CALMET
and PROFILE winds)
(NCOUNT)                                    Default: 2      ! NCOUNT =  2   !

Minimum sigma y for a new puff/slug (m)
(SYMIN)                                     Default: 1.0    ! SYMIN = 1.0  !

Minimum sigma z for a new puff/slug (m)
(SZMIN)                                     Default: 1.0    ! SZMIN = 1.0  !

Default minimum turbulence velocities sigma-v and sigma-w
for each stability class over land and over water (m/s)
(SVMIN(12) and SWMIN(12))

                ----------  LAND  ----------       ---------  WATER  ----------
   Stab Class :  A    B    C    D    E    F         A    B    C    D    E    F
                ---  ---  ---  ---  ---  ---       ---  ---  ---  ---  ---  ---
Default SVMIN : .50, .50, .50, .50, .50, .50,      .37, .37, .37, .37, .37, .37
Default SWMIN : .20, .12, .08, .06, .03, .016,     .20, .12, .08, .06, .03, .016

      ! SVMIN = 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.370, 0.370, 0.370, 0.370, 0.370, 0.370!
```

```
      ! SWMIN = 0.200, 0.120, 0.080, 0.060, 0.030, 0.016, 0.200, 0.120, 0.080, 0.060, 0.030, 0.016!

   Divergence criterion for dw/dz across puff
   used to initiate adjustment for horizontal
   convergence (1/s)
   Partial adjustment starts at CDIV(1), and
   full adjustment is reached at CDIV(2)
   (CDIV(2))                                  Default: 0.0,0.0  ! CDIV = .0, .0 !

   Minimum wind speed (m/s) allowed for
   non-calm conditions. Also used as minimum
   speed returned when using power-law
   extrapolation toward surface
   (WSCALM)                                   Default: 0.5    ! WSCALM = .5 !

   Maximum mixing height (m)
   (XMAXZI)                                   Default: 3000.  ! XMAXZI = 3000.0 !

   Minimum mixing height (m)
   (XMINZI)                                   Default: 50.    ! XMINZI = 50.0 !

   Default wind speed classes --
   5 upper bounds (m/s) are entered;
   the 6th class has no upper limit
   (WSCAT(5))                        Default   :
                                     ISC RURAL : 1.54, 3.09, 5.14, 8.23, 10.8 (10.8+)

                                Wind Speed Class :  1     2     3     4     5
                                                   ---   ---   ---   ---   ---
                                       ! WSCAT = 1.54, 3.09, 5.14, 8.23, 10.80 !

   Default wind speed profile power-law
   exponents for stabilities 1-6
   (PLX0(6))                         Default   : ISC RURAL values
                                     ISC RURAL : .07, .07, .10, .15, .35, .55
                                     ISC URBAN : .15, .15, .20, .25, .30, .30

                                 Stability Class :  A     B     C     D     E     F
                                                   ---   ---   ---   ---   ---   ---
                                       ! PLX0 = 0.07, 0.07, 0.10, 0.15, 0.35, 0.55 !

   Default potential temperature gradient
   for stable classes E, F (degK/m)
   (PTG0(2))                         Default: 0.020, 0.035
                                        ! PTG0 = 0.020,   0.035 !

   Default plume path coefficients for
   each stability class (used when option
   for partial plume height terrain adjustment
```

```
     is selected -- MCTADJ=3)
     (PPC(6))                  Stability Class :  A     B     C     D     E     F
                                  Default  PPC : .50,  .50,  .50,  .50,  .35,  .35
                                                 ---   ---   ---   ---   ---   ---
                                       !  PPC = 0.50, 0.50, 0.50, 0.50, 0.35, 0.35 !

     Slug-to-puff transition criterion factor
     equal to sigma-y/length of slug
     (SL2PF)                              Default: 10.        ! SL2PF = 5.0 !

     Puff-splitting control variables ------------------------

       VERTICAL SPLIT
       --------------

       Number of puffs that result every time a puff
       is split - nsplit=2 means that 1 puff splits
       into 2
       (NSPLIT)                           Default:   3        ! NSPLIT =  3  !

       Time(s) of a day when split puffs are eligible to
       be split once again; this is typically set once
       per day, around sunset before nocturnal shear develops.
       24 values: 0 is midnight (00:00) and 23 is 11 PM (23:00)
       0=do not re-split    1=eligible for re-split
       (IRESPLIT(24))                     Default:  Hour 17 = 1
       !  IRESPLIT = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0 !

       Split is allowed only if last hour's mixing
       height (m) exceeds a minimum value
       (ZISPLIT)                          Default: 100.       ! ZISPLIT = 100.0 !

       Split is allowed only if ratio of last hour's
       mixing ht to the maximum mixing ht experienced
       by the puff is less than a maximum value (this
       postpones a split until a nocturnal layer develops)
       (ROLDMAX)                          Default: 0.25       ! ROLDMAX = 0.25 !


       HORIZONTAL SPLIT
       ----------------

       Number of puffs that result every time a puff
       is split - nsplith=5 means that 1 puff splits
       into 5
       (NSPLITH)                          Default:   5        ! NSPLITH =  5  !

       Minimum sigma-y (Grid Cells Units) of puff
       before it may be split
```

```
       (SYSPLITH)                          Default:  1.0       ! SYSPLITH = 1.0 !

       Minimum puff elongation rate (SYSPLITH/hr) due to
       wind shear, before it may be split
       (SHSPLITH)                          Default:  2.        ! SHSPLITH = 2.0 !

       Minimum concentration (g/m^3) of each
       species in puff before it may be split
       Enter array of NSPEC values; if a single value is
       entered, it will be used for ALL species
       (CNSPLITH)                          Default:  1.0E-07   ! CNSPLITH = 1.0E-07 !

     Integration control variables ------------------------

       Fractional convergence criterion for numerical SLUG
       sampling integration
       (EPSSLUG)                           Default:   1.0e-04  ! EPSSLUG = 1.0E-04 !

       Fractional convergence criterion for numerical AREA
       source integration
       (EPSAREA)                           Default:   1.0e-06  ! EPSAREA = 1.0E-06 !

       Trajectory step-length (m) used for numerical rise
       integration
       (DSRISE)                            Default:   1.0      ! DSRISE = 1.0 !

       Boundary Condition (BC) Puff control variables -------------------------

       Minimum height (m) to which BC puffs are mixed as they are emitted
       (MBCON=2 ONLY).  Actual height is reset to the current mixing height
       at the release point if greater than this minimum.
       (HTMINBC)                           Default:   500.     ! HTMINBC = 500.0 !

       Search radius (km) about a receptor for sampling nearest BC puff.
       BC puffs are typically emitted with a spacing of one grid cell
       length, so the search radius should be greater than DGRIDKM.
       (RSAMPBC)                           Default:   10.      ! RSAMPBC = 15.0 !

       Near-Surface depletion adjustment to concentration profile used when
       sampling BC puffs?
       (MDEPBC)                            Default:   1        ! MDEPBC =  0  !
          0 = Concentration is NOT adjusted for depletion
          1 = Adjust Concentration for depletion

!END!


-------------------------------------------------------------------------------
```

INPUT GROUPS: 13a, 13b, 13c, 13d -- Point source parameters

Subgroup (13a)

Number of point sources with parameters provided below (NPT1) No default ! NPT1 = 10 !

Units used for point source emissions below (IPTU) Default: 1 ! IPTU = 1 !

1 = g/s
2 = kg/hr
3 = lb/hr
4 = tons/yr
5 = Odour Unit * m**3/s (vol. flux of odour compound)
6 = Odour Unit * m**3/min
7 = metric tons/yr

Number of source-species combinations with variable emissions scaling factors provided below in (13d) (NSPT1) Default: 0 ! NSPT1 = 0 !

Number of point sources with variable emission parameters provided in external file (NPT2) No default ! NPT2 = 0 !

(If NPT2 > 0, these point source emissions are read from the file: PTEMARB.DAT)

!END!

Subgroup (13b)

POINT SOURCE: CONSTANT DATA [a]

Source No.	X Coordinate (km)	Y Coordinate (km)	Stack Height (m)	Base Elevation (m)	Stack Diameter (m)	Exit Vel. (m/s)	Exit Temp. (deg. K)	Bldg. Dwash [b]	Emission Rates [c]
1 ! SRCNAM = 103 !									
1 ! X = 1722.333,	-110.650,	32.00,	12.2,	3.44,	13.68,	387.6,	.0,		

```
      1.47E-01, 0.00E+00, 1.74E+01, 0.00E+00, 0.00E+00,
      4.24E-01, 4.24E-01, 4.80E-02, 4.80E-02,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 4.41E-02, 2.50E-01,
      0.00E+00, 0.00E+00, 3.17E-03, 1.79E-02, 2.80E-01 !
   1 ! ZPLTFM  =       .0 !
   1 ! FMFAC  =      1.0 !   !END!

   2 ! SRCNAM = 106 !
   2 ! X = 1722.333, -110.650,   15.24,  12.2,     1.52,   6.60,  433.2,  .0,
      1.05E-02, 0.00E+00, 2.16E+00, 0.00E+00, 0.00E+00,
      3.91E-02, 3.91E-02, 4.42E-03, 4.42E-03,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 4.06E-03, 2.30E-02,
      0.00E+00, 0.00E+00, 2.91E-04, 1.65E-03, 3.64E-02 !
   2 ! ZPLTFM  =       .0 !
   2 ! FMFAC  =      1.0 !   !END!

   3 ! SRCNAM = 405 !
   3 ! X = 1722.333, -110.650,   45.72,  12.2,     0.76,  12.42,  358.2,  .0,
      1.26E+00, 1.93E-02, 3.15E+00, 0.00E+00, 0.00E+00,
      1.05E-02, 1.05E-02, 9.78E-03, 9.78E-03,
      5.52E-03, 6.44E-03, 3.41E-03, 8.52E-04, 1.70E-03, 2.98E-02,
      2.72E-04, 6.81E-05, 1.36E-04, 2.38E-03, 0.00E+00 !
   3 ! ZPLTFM  =       .0 !
   3 ! FMFAC  =      1.0 !   !END!

   4 ! SRCNAM = 902 !
   4 ! X = 1722.333, -110.650,   38.10,  12.2,     0.41,  34.77,  278.2,  .0,
      0.00E+00, 0.00E+00, 7.01E+01, 0.00E+00, 8.30E-01,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 3.84E+01 !
   4 ! ZPLTFM  =       .0 !
   4 ! FMFAC  =      1.0 !   !END!

   5 ! SRCNAM = 907 !
   5 ! X = 1722.333, -110.650,   40.23,  12.2,     0.61,  18.27,  288.2,  .0,
      2.10E-02, 0.00E+00, 3.29E+01, 0.00E+00, 0.00E+00,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
      0.00E+00, 0.00E+00, 2.04E-02, 1.16E-01, 2.75E+01 !
   5 ! ZPLTFM  =       .0 !
   5 ! FMFAC  =      1.0 !   !END!

   6 ! SRCNAM = 903 !
   6 ! X = 1722.333, -110.650,   38.10,  12.2,     0.41,  34.77,  278.2,  .0,
      0.00E+00, 0.00E+00, 2.31E+01, 0.00E+00, 1.94E-02,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 1.09E+02 !
```

```
   6 ! ZPLTFM  =       .0 !
   6 ! FMFAC  =      1.0 !   !END!

   7 ! SRCNAM = 908 !
   7 ! X = 1722.333, -110.650,   40.23,  12.2,     0.61,  18.27,  290.4,  .0,
       2.14E-02, 0.00E+00, 2.96E+01, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 1.74E-02, 9.85E-02, 1.49E+01 !
   7 ! ZPLTFM  =       .0 !
   7 ! FMFAC  =      1.0 !   !END!

   8 ! SRCNAM = 904 !
   8 ! X = 1722.333, -110.650,   35.05,  12.2,     0.61,  19.89,  278.2,  .0,
       0.00E+00, 0.00E+00, 2.31E+01, 0.00E+00, 1.94E-02,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 5.16E+01 !
   8 ! ZPLTFM  =       .0 !
   8 ! FMFAC  =      1.0 !   !END!

   9 ! SRCNAM = 909 !
   9 ! X = 1722.333, -110.650,   34.14,  12.2,     0.61,  23.46,  290.4,  .0,
       5.29E-02, 0.00E+00, 2.30E+01, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 1.57E-02, 8.92E-02, 1.57E+01 !
   9 ! ZPLTFM  =       .0 !
   9 ! FMFAC  =      1.0 !   !END!

  10 ! SRCNAM = 108 !
  10 ! X = 1722.333, -110.650,   56.39,  12.2,     1.52,  16.83,  310.9,  .0,
       5.87E+00, 6.30E-02, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00 !
  10 ! ZPLTFM  =       .0 !
  10 ! FMFAC  =      1.0 !   !END!
```

---

a
Data for each source are treated as a separate input subgroup
and therefore must end with an input group terminator.

SRCNAM is a 12-character name for a source
(No default)
X is an array holding the source data listed by the column headings
(No default)

SIGYZI is an array holding the initial sigma-y and sigma-z (m)
(Default: 0.,0.)
ZPLTFM is the platform height (m) for sources influenced by an isolated structure that has a significant open area between the surface and the bulk of the structure, such as an offshore oil platform. The Base Elevation is that of the surface (ground or ocean), and the Stack Height is the release height above the Base (not above the platform). Building heights entered in Subgroup 13c must be those of the buildings on the platform, measured from the platform deck. ZPLTFM is used only with MBDW=1 (ISC downwash method) for sources with building downwash.
(Default: 0.0)
FMFAC is a vertical momentum flux factor (0. or 1.0) used to represent the effect of rain-caps or other physical configurations that reduce momentum rise associated with the actual exit velocity.
(Default: 1.0 -- full momentum used)

b
0. = No building downwash modeled, 1. = downwash modeled
NOTE: must be entered as a REAL number (i.e., with decimal point)

c
An emission rate must be entered for every pollutant modeled.
Enter emission rate of zero for secondary pollutants that are modeled, but not emitted. Units are specified by IPTU
(e.g. 1 for g/s).

Subgroup (13c)

Source No.	BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH Effective building height, width, length and X/Y offset (in meters) every 10 degrees. LENGTH, XBADJ, and YBADJ are only needed for MBDW=2 (PRIME downwash option) [a]

---

a
Building height, width, length, and X/Y offset from the source are treated as a separate input subgroup for each source and therefore must end with an input group terminator. The X/Y offset is the position, relative to the stack, of the center of the upwind face of the projected building, with the x-axis pointing along the flow direction.

Subgroup (13d)
---

a
POINT SOURCE: VARIABLE EMISSIONS DATA

Use this subgroup to describe temporal variations in the emission rates given in 13b. Factors entered multiply the rates in 13b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use PTEMARB.DAT and NPT2 > 0.

IVARY determines the type of variation, and is source-specific:
(IVARY) Default: 0

0 =	Constant	
1 =	Diurnal cycle	(24 scaling factors: hours 1-24)
2 =	Monthly cycle	(12 scaling factors: months 1-12)
3 =	Hour & Season	(4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB)
4 =	Speed & Stab.	(6 groups of 6 scaling factors, where first group is Stability Class A, and the speed classes have upper bounds (m/s) defined in Group 12
5 =	Temperature	(12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)

---
a
Data for each species are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUPS: 14a, 14b, 14c, 14d -- Area source parameters

Subgroup (14a)

Number of polygon area sources with parameters specified below (NAR1) No default ! NAR1 = 0 !

```
     Units used for area source
     emissions below            (IARU)       Default: 1  !  IARU =   1  !
           1 =        g/m**2/s
           2 =       kg/m**2/hr
           3 =       lb/m**2/hr
           4 =     tons/m**2/yr
           5 =     Odour Unit * m/s  (vol. flux/m**2 of odour compound)
           6 =     Odour Unit * m/min
           7 =     metric tons/m**2/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (14d)        (NSAR1) Default: 0  !  NSAR1 =  0  !

     Number of buoyant polygon area sources
     with variable location and emission
     parameters (NAR2)                      No default  !  NAR2 =  0   !
     (If NAR2 > 0, ALL parameter data for
     these sources are read from the file: BAEMARB.DAT)

!END!

---------------
Subgroup (14b)
---------------
                                   a
          AREA SOURCE: CONSTANT DATA
          ---------------------------
                                                              b
Source           Effect.    Base      Initial    Emission
 No.             Height   Elevation   Sigma z     Rates
                   (m)       (m)        (m)
-------          ------    ------     --------   ---------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.
    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IARU
     (e.g. 1 for g/m**2/s).

---------------
Subgroup (14c)
---------------
```

```
           COORDINATES (km) FOR EACH VERTEX(4) OF EACH POLYGON
           ---------------------------------------------------
Source                                                          a
 No.       Ordered list of X followed by list of Y, grouped by source
------     ----------------------------------------------------------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.


---------------
Subgroup (14d)
---------------
                                          a
          AREA SOURCE: VARIABLE EMISSIONS DATA
          ------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 14b.  Factors entered multiply the rates in 14b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use BAEMARB.DAT and NAR2 > 0.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                              Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)



--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.
```

```
--------------------------------------------------------------------------------

INPUT GROUPS: 15a, 15b, 15c -- Line source parameters
---------------------------

---------------
Subgroup (15a)
---------------

     Number of buoyant line sources
     with variable location and emission
     parameters (NLN2)                          No default  !  NLN2 =  0   !

     (If NLN2 > 0, ALL parameter data for
      these sources are read from the file: LNEMARB.DAT)

     Number of buoyant line sources (NLINES)    No default   ! NLINES =  0  !

     Units used for line source
     emissions below            (ILNU)          Default: 1  !  ILNU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (15c)    (NSLN1) Default: 0  !  NSLN1 =  0  !

     Maximum number of segments used to model
     each line (MXNSEG)                         Default: 7   ! MXNSEG =  7  !

     The following variables are required only if NLINES > 0.  They are
     used in the buoyant line source plume rise calculations.

        Number of distances at which            Default: 6   ! NLRISE =  6  !
        transitional rise is computed

        Average building length (XL)            No default   ! XL = .0 !
                                                (in meters)

        Average building height (HBL)           No default   ! HBL = .0 !
                                                (in meters)
```

```
        Average building width (WBL)                No default   ! WBL = .0 !
                                                    (in meters)

        Average line source width (WML)             No default   ! WML = .0 !
                                                    (in meters)

        Average separation between buildings (DXL)  No default   ! DXL = .0 !
                                                    (in meters)

        Average buoyancy parameter (FPRIMEL)        No default   ! FPRIMEL = .0 !
                                                    (in m**4/s**3)

!END!

---------------
Subgroup (15b)
---------------

          BUOYANT LINE SOURCE: CONSTANT DATA
          ----------------------------------
                                                                                  a
Source     Beg. X      Beg. Y      End. X    End. Y     Release    Base        Emission
 No.     Coordinate  Coordinate  Coordinate Coordinate  Height    Elevation     Rates
           (km)        (km)        (km)       (km)       (m)       (m)
------   ----------  ----------  ---------  ----------  -------   ---------    ---------

--------

    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by ILNTU
     (e.g. 1 for g/s).

---------------
Subgroup (15c)
---------------
                                                 a
          BUOYANT LINE SOURCE: VARIABLE EMISSIONS DATA
          --------------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 15b.  Factors entered multiply the rates in 15b.
     Skip sources here that have constant emissions.
```

```
     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                  Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)



--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


------------------------------------------------------------------------------


INPUT GROUPS: 16a, 16b, 16c -- Volume source parameters
---------------------------

---------------
Subgroup (16a)
---------------

     Number of volume sources with
     parameters provided in 16b,c (NVL1)     No default  !  NVL1 =  0   !

     Units used for volume source
     emissions below in 16b       (IVLU)     Default: 1  !  IVLU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
```

```
     emissions scaling factors
     provided below in (16c)      (NSVL1)    Default: 0  !  NSVL1 =  0  !

     Number of volume sources with
     variable location and emission
     parameters                   (NVL2)     No default  !  NVL2 =   0   !

     (If NVL2 > 0, ALL parameter data for
      these sources are read from the VOLEMARB.DAT file(s) )

!END!

---------------
Subgroup (16b)
---------------
                                        a
           VOLUME SOURCE: CONSTANT DATA
           ----------------------------
                                                                        b
         X           Y        Effect.    Base     Initial    Initial    Emission
     Coordinate  Coordinate   Height   Elevation  Sigma y    Sigma z     Rates
        (km)        (km)        (m)       (m)       (m)        (m)
     ----------  ----------   ------    ------    --------   --------   --------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IVLU
     (e.g. 1 for g/s).

---------------
Subgroup (16c)
---------------
                                                 a
           VOLUME SOURCE: VARIABLE EMISSIONS DATA
           --------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 16b.  Factors entered multiply the rates in 16b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use VOLEMARB.DAT and NVL2 > 0.

     IVARY determines the type of variation, and is source-specific:
```

```
     (IVARY)                                Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)
```

---

a
Data for each species are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUPS: 17a & 17b -- Non-gridded (discrete) receptor information

---

Subgroup (17a)

Number of non-gridded receptors (NREC) No default ! NREC = 589 !

!END!

Subgroup (17b)

---

a

NON-GRIDDED (DISCRETE) RECEPTOR DATA

Receptor No.	X Coordinate (km)	Y Coordinate (km)	Ground Elevation (m)	Height Above Ground (m) b	
1 ! X =	1570.525,	-58.686,	700.0,	0.00, !	!END!
2 ! X =	1571.581,	-56.591,	626.0,	0.00, !	!END!

```
3 ! X =    1574.426,      -56.014,      781.0,      0.00, !  !END!
4 ! X =    1573.692,      -52.402,      515.0,      0.00, !  !END!
5 ! X =    1571.904,      -50.884,      607.0,      0.00, !  !END!
6 ! X =    1573.325,      -50.595,      557.0,      0.00, !  !END!
7 ! X =    1574.746,      -50.307,      676.0,      0.00, !  !END!
8 ! X =    1576.167,      -50.018,      541.0,      0.00, !  !END!
9 ! X =    1571.538,      -49.078,      586.0,      0.00, !  !END!
10 ! X =    1572.959,      -48.789,      767.0,      0.00, !  !END!
11 ! X =    1574.379,      -48.501,      708.0,      0.00, !  !END!
12 ! X =    1575.800,      -48.212,      430.0,      0.00, !  !END!
13 ! X =    1572.592,      -46.983,      563.0,      0.00, !  !END!
14 ! X =    1574.012,      -46.695,      830.0,      0.00, !  !END!
15 ! X =    1575.433,      -46.406,      564.0,      0.00, !  !END!
16 ! X =    1576.853,      -46.117,      434.0,      0.00, !  !END!
17 ! X =    1570.805,      -45.465,      452.0,      0.00, !  !END!
18 ! X =    1572.225,      -45.177,      582.0,      0.00, !  !END!
19 ! X =    1573.645,      -44.888,      739.0,      0.00, !  !END!
20 ! X =    1575.065,      -44.600,      821.0,      0.00, !  !END!
21 ! X =    1576.485,      -44.311,      451.0,      0.00, !  !END!
22 ! X =    1571.858,      -43.371,      761.0,      0.00, !  !END!
23 ! X =    1573.278,      -43.082,      733.0,      0.00, !  !END!
24 ! X =    1574.698,      -42.794,      823.0,      0.00, !  !END!
25 ! X =    1576.118,      -42.505,      602.0,      0.00, !  !END!
26 ! X =    1571.492,      -41.565,      507.0,      0.00, !  !END!
27 ! X =    1572.911,      -41.276,      474.0,      0.00, !  !END!
28 ! X =    1574.331,      -40.988,      602.0,      0.00, !  !END!
29 ! X =    1575.750,      -40.699,      734.0,      0.00, !  !END!
30 ! X =    1578.588,      -40.120,      602.0,      0.00, !  !END!
31 ! X =    1572.544,      -39.470,      623.0,      0.00, !  !END!
32 ! X =    1573.963,      -39.182,      742.0,      0.00, !  !END!
33 ! X =    1575.382,      -38.893,      749.0,      0.00, !  !END!
34 ! X =    1576.801,      -38.604,      764.0,      0.00, !  !END!
35 ! X =    1579.639,      -38.025,      534.0,      0.00, !  !END!
36 ! X =    1572.177,      -37.664,      616.0,      0.00, !  !END!
37 ! X =    1573.596,      -37.376,      704.0,      0.00, !  !END!
38 ! X =    1575.014,      -37.087,      726.0,      0.00, !  !END!
39 ! X =    1576.433,      -36.798,      792.0,      0.00, !  !END!
40 ! X =    1577.852,      -36.509,      706.0,      0.00, !  !END!
41 ! X =    1579.270,      -36.219,      481.0,      0.00, !  !END!
42 ! X =    1570.392,      -36.146,      412.0,      0.00, !  !END!
43 ! X =    1571.810,      -35.858,      461.0,      0.00, !  !END!
44 ! X =    1573.228,      -35.570,      742.0,      0.00, !  !END!
45 ! X =    1574.647,      -35.281,      493.0,      0.00, !  !END!
46 ! X =    1576.065,      -34.992,      556.0,      0.00, !  !END!
47 ! X =    1577.483,      -34.703,      781.0,      0.00, !  !END!
48 ! X =    1578.901,      -34.413,      823.0,      0.00, !  !END!
49 ! X =    1580.320,      -34.124,      854.0,      0.00, !  !END!
50 ! X =    1581.738,      -33.834,      818.0,      0.00, !  !END!
51 ! X =    1583.156,      -33.543,      631.0,      0.00, !  !END!
```

```
52 ! X =    1572.861,      -33.764,      539.0,      0.00, !  !END!
53 ! X =    1574.279,      -33.475,      649.0,      0.00, !  !END!
54 ! X =    1575.697,      -33.186,      737.0,      0.00, !  !END!
55 ! X =    1577.115,      -32.897,      612.0,      0.00, !  !END!
56 ! X =    1578.533,      -32.608,      582.0,      0.00, !  !END!
57 ! X =    1579.951,      -32.318,      650.0,      0.00, !  !END!
58 ! X =    1581.368,      -32.028,      829.0,      0.00, !  !END!
59 ! X =    1582.786,      -31.738,      825.0,      0.00, !  !END!
60 ! X =    1584.204,      -31.448,      482.0,      0.00, !  !END!
61 ! X =    1573.911,      -31.669,      609.0,      0.00, !  !END!
62 ! X =    1575.329,      -31.380,      585.0,      0.00, !  !END!
63 ! X =    1576.746,      -31.091,      757.0,      0.00, !  !END!
64 ! X =    1578.164,      -30.802,      458.0,      0.00, !  !END!
65 ! X =    1579.581,      -30.512,      582.0,      0.00, !  !END!
66 ! X =    1580.999,      -30.222,      825.0,      0.00, !  !END!
67 ! X =    1582.416,      -29.932,      691.0,      0.00, !  !END!
68 ! X =    1583.834,      -29.642,      427.0,      0.00, !  !END!
69 ! X =    1574.961,      -29.574,      472.0,      0.00, !  !END!
70 ! X =    1576.378,      -29.285,      721.0,      0.00, !  !END!
71 ! X =    1577.795,      -28.996,      459.0,      0.00, !  !END!
72 ! X =    1579.212,      -28.707,      824.0,      0.00, !  !END!
73 ! X =    1580.630,      -28.417,      728.0,      0.00, !  !END!
74 ! X =    1582.047,      -28.127,      764.0,      0.00, !  !END!
75 ! X =    1583.464,      -27.837,      769.0,      0.00, !  !END!
76 ! X =    1584.880,      -27.546,      859.0,      0.00, !  !END!
77 ! X =    1577.427,      -27.190,      457.0,      0.00, !  !END!
78 ! X =    1578.843,      -26.901,      575.0,      0.00, !  !END!
79 ! X =    1580.260,      -26.611,      548.0,      0.00, !  !END!
80 ! X =    1581.677,      -26.321,      661.0,      0.00, !  !END!
81 ! X =    1583.094,      -26.031,      547.0,      0.00, !  !END!
82 ! X =    1584.510,      -25.741,      821.0,      0.00, !  !END!
83 ! X =    1585.927,      -25.450,      691.0,      0.00, !  !END!
84 ! X =    1579.891,      -24.806,      538.0,      0.00, !  !END!
85 ! X =    1581.307,      -24.516,      649.0,      0.00, !  !END!
86 ! X =    1585.556,      -23.645,      579.0,      0.00, !  !END!
87 ! X =    1586.972,      -23.354,      821.0,      0.00, !  !END!
88 ! X =    1588.388,      -23.063,      913.0,      0.00, !  !END!
89 ! X =    1589.804,      -22.771,      890.0,      0.00, !  !END!
90 ! X =    1579.521,      -23.000,      430.0,      0.00, !  !END!
91 ! X =    1580.937,      -22.710,      516.0,      0.00, !  !END!
92 ! X =    1582.353,      -22.420,      458.0,      0.00, !  !END!
93 ! X =    1588.017,      -21.257,      671.0,      0.00, !  !END!
94 ! X =    1589.433,      -20.966,      750.0,      0.00, !  !END!
95 ! X =    1590.848,      -20.674,      541.0,      0.00, !  !END!
96 ! X =    1592.264,      -20.383,      429.0,      0.00, !  !END!
97 ! X =    1581.983,      -20.615,      457.0,      0.00, !  !END!
98 ! X =    1583.399,      -20.325,      488.0,      0.00, !  !END!
99 ! X =    1584.815,      -20.034,      412.0,      0.00, !  !END!
100 ! X =    1586.230,      -19.743,      465.0,      0.00, !  !END!
```

```
101 ! X =    1587.646,      -19.452,      624.0,      0.00, !  !END!
102 ! X =    1589.061,      -19.161,      763.0,      0.00, !  !END!
103 ! X =    1590.476,      -18.869,      849.0,      0.00, !  !END!
104 ! X =    1591.892,      -18.578,      820.0,      0.00, !  !END!
105 ! X =    1593.307,      -18.286,      893.0,      0.00, !  !END!
106 ! X =    1583.029,      -18.519,      456.0,      0.00, !  !END!
107 ! X =    1588.689,      -17.356,      544.0,      0.00, !  !END!
108 ! X =    1590.104,      -17.064,      827.0,      0.00, !  !END!
109 ! X =    1591.519,      -16.773,      796.0,      0.00, !  !END!
110 ! X =    1592.934,      -16.481,      579.0,      0.00, !  !END!
111 ! X =    1589.732,      -15.259,      710.0,      0.00, !  !END!
112 ! X =    1591.147,      -14.968,      983.0,      0.00, !  !END!
113 ! X =    1592.561,      -14.676,      943.0,      0.00, !  !END!
114 ! X =    1593.976,      -14.384,      790.0,      0.00, !  !END!
115 ! X =    1595.390,      -14.091,      700.0,      0.00, !  !END!
116 ! X =    1587.946,      -13.746,      455.0,      0.00, !  !END!
117 ! X =    1590.775,      -13.163,      631.0,      0.00, !  !END!
118 ! X =    1592.189,      -12.871,      979.0,      0.00, !  !END!
119 ! X =    1593.603,      -12.579,      716.0,      0.00, !  !END!
120 ! X =    1595.017,      -12.286,      709.0,      0.00, !  !END!
121 ! X =    1596.431,      -11.994,      452.0,      0.00, !  !END!
122 ! X =    1588.988,      -11.649,      519.0,      0.00, !  !END!
123 ! X =    1591.816,      -11.066,      717.0,      0.00, !  !END!
124 ! X =    1593.230,      -10.774,      950.0,      0.00, !  !END!
125 ! X =    1591.443,      -9.261,      653.0,      0.00, !  !END!
126 ! X =    1592.857,      -8.969,      908.0,      0.00, !  !END!
127 ! X =    1594.270,      -8.677,      977.0,      0.00, !  !END!
128 ! X =    1595.684,      -8.384,      792.0,      0.00, !  !END!
129 ! X =    1601.337,      -7.212,      398.0,      0.00, !  !END!
130 ! X =    1602.750,      -6.918,      395.0,      0.00, !  !END!
131 ! X =    1591.071,      -7.456,      486.0,      0.00, !  !END!
132 ! X =    1592.484,      -7.164,      618.0,      0.00, !  !END!
133 ! X =    1593.897,      -6.872,      934.0,      0.00, !  !END!
134 ! X =    1595.310,      -6.580,      700.0,      0.00, !  !END!
135 ! X =    1598.136,      -5.994,      800.0,      0.00, !  !END!
136 ! X =    1600.962,      -5.407,      579.0,      0.00, !  !END!
137 ! X =    1602.375,      -5.114,      475.0,      0.00, !  !END!
138 ! X =    1586.459,      -6.526,      768.0,      0.00, !  !END!
139 ! X =    1592.111,      -5.360,      579.0,      0.00, !  !END!
140 ! X =    1593.524,      -5.068,      869.0,      0.00, !  !END!
141 ! X =    1594.937,      -4.775,      1059.0,      0.00, !  !END!
142 ! X =    1596.349,      -4.483,      871.0,      0.00, !  !END!
143 ! X =    1586.088,      -4.721,      627.0,      0.00, !  !END!
144 ! X =    1587.500,      -4.430,      695.0,      0.00, !  !END!
145 ! X =    1588.913,      -4.138,      600.0,      0.00, !  !END!
146 ! X =    1590.325,      -3.847,      601.0,      0.00, !  !END!
147 ! X =    1591.738,      -3.555,      831.0,      0.00, !  !END!
148 ! X =    1593.150,      -3.263,      844.0,      0.00, !  !END!
149 ! X =    1594.563,      -2.971,      1033.0,      0.00, !  !END!
```

```
150 ! X =    1595.975,      -2.678,      915.0,      0.00, !  !END!
151 ! X =    1597.388,      -2.385,      775.0,      0.00, !  !END!
152 ! X =    1584.303,      -3.206,      507.0,      0.00, !  !END!
153 ! X =    1585.716,      -2.916,      611.0,      0.00, !  !END!
154 ! X =    1594.189,      -1.166,      1018.0,      0.00, !  !END!
155 ! X =    1595.601,      -0.873,      1066.0,      0.00, !  !END!
156 ! X =    1597.013,      -0.581,      1017.0,      0.00, !  !END!
157 ! X =    1598.425,      -0.288,      614.0,      0.00, !  !END!
158 ! X =    1599.837,      0.006,      407.0,      0.00, !  !END!
159 ! X =    1604.072,      0.887,      317.0,      0.00, !  !END!
160 ! X =    1593.816,      0.639,      1025.0,      0.00, !  !END!
161 ! X =    1595.227,      0.931,      1031.0,      0.00, !  !END!
162 ! X =    1596.639,      1.224,      767.0,      0.00, !  !END!
163 ! X =    1598.051,      1.517,      833.0,      0.00, !  !END!
164 ! X =    1599.462,      1.810,      833.0,      0.00, !  !END!
165 ! X =    1600.874,      2.103,      500.0,      0.00, !  !END!
166 ! X =    1603.696,      2.691,      628.0,      0.00, !  !END!
167 ! X =    1605.108,      2.985,      569.0,      0.00, !  !END!
168 ! X =    1594.853,      2.736,      579.0,      0.00, !  !END!
169 ! X =    1596.265,      3.028,      975.0,      0.00, !  !END!
170 ! X =    1597.676,      3.321,      1123.0,      0.00, !  !END!
171 ! X =    1599.087,      3.614,      858.0,      0.00, !  !END!
172 ! X =    1600.498,      3.908,      628.0,      0.00, !  !END!
173 ! X =    1603.320,      4.495,      750.0,      0.00, !  !END!
174 ! X =    1604.731,      4.789,      777.0,      0.00, !  !END!
175 ! X =    1606.142,      5.084,      446.0,      0.00, !  !END!
176 ! X =    1595.890,      4.833,      893.0,      0.00, !  !END!
177 ! X =    1597.301,      5.126,      813.0,      0.00, !  !END!
178 ! X =    1598.712,      5.419,      1036.0,      0.00, !  !END!
179 ! X =    1600.123,      5.712,      770.0,      0.00, !  !END!
180 ! X =    1601.534,      6.006,      735.0,      0.00, !  !END!
181 ! X =    1602.944,      6.299,      567.0,      0.00, !  !END!
182 ! X =    1604.355,      6.593,      514.0,      0.00, !  !END!
183 ! X =    1605.766,      6.888,      466.0,      0.00, !  !END!
184 ! X =    1596.927,      6.930,      720.0,      0.00, !  !END!
185 ! X =    1598.337,      7.223,      1005.0,      0.00, !  !END!
186 ! X =    1599.748,      7.516,      975.0,      0.00, !  !END!
187 ! X =    1601.158,      7.810,      854.0,      0.00, !  !END!
188 ! X =    1602.568,      8.103,      732.0,      0.00, !  !END!
189 ! X =    1603.979,      8.398,      463.0,      0.00, !  !END!
190 ! X =    1605.389,      8.692,      355.0,      0.00, !  !END!
191 ! X =    1596.552,      8.734,      888.0,      0.00, !  !END!
192 ! X =    1597.962,      9.027,      1085.0,      0.00, !  !END!
193 ! X =    1599.372,      9.320,      1043.0,      0.00, !  !END!
194 ! X =    1600.782,      9.614,      749.0,      0.00, !  !END!
195 ! X =    1602.192,      9.908,      572.0,      0.00, !  !END!
196 ! X =    1603.602,      10.202,      458.0,      0.00, !  !END!
197 ! X =    1605.012,      10.496,      640.0,      0.00, !  !END!
198 ! X =    1606.422,      10.790,      450.0,      0.00, !  !END!
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199 ! X =    1596.177,      10.539,      468.0,      0.00, !  !END!
200 ! X =    1597.587,      10.832,      600.0,      0.00, !  !END!
201 ! X =    1598.997,      11.125,      942.0,      0.00, !  !END!
202 ! X =    1600.407,      11.418,      830.0,      0.00, !  !END!
203 ! X =    1601.817,      11.712,      915.0,      0.00, !  !END!
204 ! X =    1603.226,      12.006,      730.0,      0.00, !  !END!
205 ! X =    1604.636,      12.300,      778.0,      0.00, !  !END!
206 ! X =    1606.045,      12.594,      689.0,      0.00, !  !END!
207 ! X =    1598.622,      12.929,      618.0,      0.00, !  !END!
208 ! X =    1600.031,      13.222,      761.0,      0.00, !  !END!
209 ! X =    1601.441,      13.516,      1090.0,      0.00, !  !END!
210 ! X =    1602.850,      13.810,      810.0,      0.00, !  !END!
211 ! X =    1604.259,      14.104,      701.0,      0.00, !  !END!
212 ! X =    1605.668,      14.398,      578.0,      0.00, !  !END!
213 ! X =    1607.078,      14.693,      508.0,      0.00, !  !END!
214 ! X =    1601.065,      15.320,      743.0,      0.00, !  !END!
215 ! X =    1602.474,      15.614,      913.0,      0.00, !  !END!
216 ! X =    1603.883,      15.908,      535.0,      0.00, !  !END!
217 ! X =    1605.291,      16.202,      425.0,      0.00, !  !END!
218 ! X =    1606.700,      16.497,      315.0,      0.00, !  !END!
219 ! X =    1596.462,      16.244,      436.0,      0.00, !  !END!
220 ! X =    1599.280,      16.831,      447.0,      0.00, !  !END!
221 ! X =    1600.689,      17.124,      675.0,      0.00, !  !END!
222 ! X =    1602.097,      17.418,      672.0,      0.00, !  !END!
223 ! X =    1603.506,      17.712,      440.0,      0.00, !  !END!
224 ! X =    1604.915,      18.006,      464.0,      0.00, !  !END!
225 ! X =    1600.313,      18.928,      738.0,      0.00, !  !END!
226 ! X =    1601.721,      19.222,      832.0,      0.00, !  !END!
227 ! X =    1603.129,      19.516,      611.0,      0.00, !  !END!
228 ! X =    1604.538,      19.810,      507.0,      0.00, !  !END!
229 ! X =    1595.712,      19.853,      476.0,      0.00, !  !END!
230 ! X =    1597.121,      20.146,      778.0,      0.00, !  !END!
231 ! X =    1599.937,      20.732,      643.0,      0.00, !  !END!
232 ! X =    1601.345,      21.026,      695.0,      0.00, !  !END!
233 ! X =    1602.753,      21.320,      426.0,      0.00, !  !END!
234 ! X =    1604.161,      21.614,      367.0,      0.00, !  !END!
235 ! X =    1593.929,      21.365,      338.0,      0.00, !  !END!
236 ! X =    1595.337,      21.657,      336.0,      0.00, !  !END!
237 ! X =    1596.745,      21.950,      395.0,      0.00, !  !END!
238 ! X =    1598.153,      22.243,      436.0,      0.00, !  !END!
239 ! X =    1599.561,      22.536,      701.0,      0.00, !  !END!
240 ! X =    1600.968,      22.830,      568.0,      0.00, !  !END!
241 ! X =    1602.376,      23.123,      528.0,      0.00, !  !END!
242 ! X =    1603.784,      23.417,      448.0,      0.00, !  !END!
243 ! X =    1605.191,      23.712,      625.0,      0.00, !  !END!
244 ! X =    1606.599,      24.006,      431.0,      0.00, !  !END!
245 ! X =    1596.370,      23.754,      582.0,      0.00, !  !END!
246 ! X =    1597.777,      24.047,      791.0,      0.00, !  !END!
247 ! X =    1599.185,      24.340,      589.0,      0.00, !  !END!
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248 ! X =    1600.592,      24.634,      586.0,      0.00, !  !END!
249 ! X =    1601.999,      24.927,      694.0,      0.00, !  !END!
250 ! X =    1603.407,      25.221,      638.0,      0.00, !  !END!
251 ! X =    1604.814,      25.516,      432.0,      0.00, !  !END!
252 ! X =    1597.402,      25.851,      571.0,      0.00, !  !END!
253 ! X =    1598.809,      26.144,      582.0,      0.00, !  !END!
254 ! X =    1600.216,      26.438,      661.0,      0.00, !  !END!
255 ! X =    1601.623,      26.731,      923.0,      0.00, !  !END!
256 ! X =    1603.030,      27.025,      794.0,      0.00, !  !END!
257 ! X =    1604.437,      27.319,      715.0,      0.00, !  !END!
258 ! X =    1611.470,      28.794,      526.0,      0.00, !  !END!
259 ! X =    1599.840,      28.242,      684.0,      0.00, !  !END!
260 ! X =    1601.246,      28.535,      848.0,      0.00, !  !END!
261 ! X =    1602.653,      28.829,      1006.0,      0.00, !  !END!
262 ! X =    1604.059,      29.123,      771.0,      0.00, !  !END!
263 ! X =    1605.466,      29.417,      753.0,      0.00, !  !END!
264 ! X =    1606.872,      29.712,      786.0,      0.00, !  !END!
265 ! X =    1608.279,      30.007,      740.0,      0.00, !  !END!
266 ! X =    1609.685,      30.302,      637.0,      0.00, !  !END!
267 ! X =    1611.091,      30.597,      607.0,      0.00, !  !END!
268 ! X =    1596.651,      29.460,      265.0,      0.00, !  !END!
269 ! X =    1598.057,      29.753,      368.0,      0.00, !  !END!
270 ! X =    1599.463,      30.046,      468.0,      0.00, !  !END!
271 ! X =    1600.870,      30.339,      647.0,      0.00, !  !END!
272 ! X =    1602.276,      30.633,      583.0,      0.00, !  !END!
273 ! X =    1605.088,      31.221,      450.0,      0.00, !  !END!
274 ! X =    1606.494,      31.516,      612.0,      0.00, !  !END!
275 ! X =    1607.900,      31.810,      712.0,      0.00, !  !END!
276 ! X =    1609.306,      32.105,      945.0,      0.00, !  !END!
277 ! X =    1610.712,      32.401,      693.0,      0.00, !  !END!
278 ! X =    1597.681,      31.557,      273.0,      0.00, !  !END!
279 ! X =    1599.087,      31.850,      336.0,      0.00, !  !END!
280 ! X =    1600.493,      32.143,      640.0,      0.00, !  !END!
281 ! X =    1601.899,      32.437,      607.0,      0.00, !  !END!
282 ! X =    1608.928,      33.909,      573.0,      0.00, !  !END!
283 ! X =    1610.333,      34.204,      781.0,      0.00, !  !END!
284 ! X =    1611.739,      34.500,      563.0,      0.00, !  !END!
285 ! X =    1597.305,      33.361,      247.0,      0.00, !  !END!
286 ! X =    1608.549,      35.712,      581.0,      0.00, !  !END!
287 ! X =    1609.954,      36.008,      736.0,      0.00, !  !END!
288 ! X =    1611.360,      36.303,      644.0,      0.00, !  !END!
289 ! X =    1608.171,      37.516,      474.0,      0.00, !  !END!
290 ! X =    1609.575,      37.811,      625.0,      0.00, !  !END!
291 ! X =    1610.980,      38.106,      660.0,      0.00, !  !END!
292 ! X =    1607.792,      39.319,      494.0,      0.00, !  !END!
293 ! X =    1609.197,      39.614,      462.0,      0.00, !  !END!
294 ! X =    1607.413,      41.123,      454.0,      0.00, !  !END!
295 ! X =    1605.631,      42.632,      444.0,      0.00, !  !END!
296 ! X =    1607.035,      42.927,      468.0,      0.00, !  !END!
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297 ! X =    1608.439,      43.221,      304.0,      0.00, !  !END!
298 ! X =    1606.656,      44.730,      306.0,      0.00, !  !END!
299 ! X =    1528.821,      -121.486,      735.0,      0.00, !  !END!
300 ! X =    1529.538,      -121.346,      762.0,      0.00, !  !END!
301 ! X =    1530.255,      -121.206,      771.0,      0.00, !  !END!
302 ! X =    1526.493,      -121.002,      480.0,      0.00, !  !END!
303 ! X =    1527.210,      -120.862,      610.0,      0.00, !  !END!
304 ! X =    1527.927,      -120.722,      460.0,      0.00, !  !END!
305 ! X =    1528.644,      -120.582,      560.0,      0.00, !  !END!
306 ! X =    1529.361,      -120.441,      678.0,      0.00, !  !END!
307 ! X =    1530.078,      -120.301,      731.0,      0.00, !  !END!
308 ! X =    1530.795,      -120.161,      792.0,      0.00, !  !END!
309 ! X =    1531.512,      -120.020,      612.0,      0.00, !  !END!
310 ! X =    1526.317,      -120.097,      484.0,      0.00, !  !END!
311 ! X =    1527.034,      -119.957,      619.0,      0.00, !  !END!
312 ! X =    1527.751,      -119.817,      696.0,      0.00, !  !END!
313 ! X =    1528.468,      -119.677,      608.0,      0.00, !  !END!
314 ! X =    1529.184,      -119.537,      759.0,      0.00, !  !END!
315 ! X =    1529.901,      -119.397,      791.0,      0.00, !  !END!
316 ! X =    1530.618,      -119.256,      503.0,      0.00, !  !END!
317 ! X =    1531.335,      -119.116,      398.0,      0.00, !  !END!
318 ! X =    1525.423,      -119.333,      447.0,      0.00, !  !END!
319 ! X =    1526.140,      -119.193,      544.0,      0.00, !  !END!
320 ! X =    1526.857,      -119.053,      604.0,      0.00, !  !END!
321 ! X =    1527.574,      -118.913,      789.0,      0.00, !  !END!
322 ! X =    1528.291,      -118.773,      770.0,      0.00, !  !END!
323 ! X =    1529.008,      -118.632,      739.0,      0.00, !  !END!
324 ! X =    1529.724,      -118.492,      609.0,      0.00, !  !END!
325 ! X =    1530.441,      -118.352,      463.0,      0.00, !  !END!
326 ! X =    1531.158,      -118.211,      457.0,      0.00, !  !END!
327 ! X =    1531.875,      -118.071,      390.0,      0.00, !  !END!
328 ! X =    1525.247,      -118.428,      347.0,      0.00, !  !END!
329 ! X =    1525.964,      -118.288,      465.0,      0.00, !  !END!
330 ! X =    1526.680,      -118.148,      609.0,      0.00, !  !END!
331 ! X =    1527.397,      -118.008,      551.0,      0.00, !  !END!
332 ! X =    1528.114,      -117.868,      670.0,      0.00, !  !END!
333 ! X =    1528.831,      -117.728,      470.0,      0.00, !  !END!
334 ! X =    1529.547,      -117.588,      397.0,      0.00, !  !END!
335 ! X =    1530.264,      -117.447,      425.0,      0.00, !  !END!
336 ! X =    1530.981,      -117.307,      333.0,      0.00, !  !END!
337 ! X =    1531.697,      -117.166,      360.0,      0.00, !  !END!
338 ! X =    1532.414,      -117.026,      363.0,      0.00, !  !END!
339 ! X =    1526.504,      -117.243,      441.0,      0.00, !  !END!
340 ! X =    1527.220,      -117.103,      491.0,      0.00, !  !END!
341 ! X =    1527.937,      -116.963,      569.0,      0.00, !  !END!
342 ! X =    1528.654,      -116.823,      303.0,      0.00, !  !END!
343 ! X =    1529.370,      -116.683,      254.0,      0.00, !  !END!
344 ! X =    1531.520,      -116.262,      333.0,      0.00, !  !END!
345 ! X =    1532.237,      -116.122,      214.0,      0.00, !  !END!
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346 ! X =    1527.044,      -116.199,      340.0,      0.00, !  !END!
347 ! X =    1527.760,      -116.059,      479.0,      0.00, !  !END!
348 ! X =    1528.477,      -115.919,      468.0,      0.00, !  !END!
349 ! X =    1529.193,      -115.778,      213.0,      0.00, !  !END!
350 ! X =    1528.300,      -115.014,      275.0,      0.00, !  !END!
351 ! X =    1857.330,      -305.922,      0.0,      0.00, !  !END!
352 ! X =    1858.064,      -305.752,      1.0,      0.00, !  !END!
353 ! X =    1857.122,      -305.023,      1.0,      0.00, !  !END!
354 ! X =    1857.856,      -304.852,      1.0,      0.00, !  !END!
355 ! X =    1856.913,      -304.123,      0.0,      0.00, !  !END!
356 ! X =    1848.632,      -305.092,      0.0,      0.00, !  !END!
357 ! X =    1844.755,      -305.040,      0.0,      0.00, !  !END!
358 ! X =    1856.496,      -302.324,      0.0,      0.00, !  !END!
359 ! X =    1857.229,      -302.154,      1.0,      0.00, !  !END!
360 ! X =    1857.963,      -301.984,      1.0,      0.00, !  !END!
361 ! X =    1861.631,      -301.131,      1.0,      0.00, !  !END!
362 ! X =    1862.364,      -300.960,      1.0,      0.00, !  !END!
363 ! X =    1863.831,      -300.619,      1.0,      0.00, !  !END!
364 ! X =    1864.565,      -300.448,      1.0,      0.00, !  !END!
365 ! X =    1846.015,      -303.801,      1.0,      0.00, !  !END!
366 ! X =    1850.418,      -302.784,      1.0,      0.00, !  !END!
367 ! X =    1854.086,      -301.935,      0.0,      0.00, !  !END!
368 ! X =    1854.820,      -301.765,      0.0,      0.00, !  !END!
369 ! X =    1855.553,      -301.595,      1.0,      0.00, !  !END!
370 ! X =    1856.287,      -301.425,      1.0,      0.00, !  !END!
371 ! X =    1857.020,      -301.255,      1.0,      0.00, !  !END!
372 ! X =    1857.754,      -301.084,      1.0,      0.00, !  !END!
373 ! X =    1860.688,      -300.402,      0.0,      0.00, !  !END!
374 ! X =    1861.421,      -300.232,      1.0,      0.00, !  !END!
375 ! X =    1862.155,      -300.061,      1.0,      0.00, !  !END!
376 ! X =    1862.888,      -299.890,      1.0,      0.00, !  !END!
377 ! X =    1863.622,      -299.719,      1.0,      0.00, !  !END!
378 ! X =    1845.074,      -303.071,      0.0,      0.00, !  !END!
379 ! X =    1845.808,      -302.902,      1.0,      0.00, !  !END!
380 ! X =    1847.275,      -302.563,      1.0,      0.00, !  !END!
381 ! X =    1848.743,      -302.224,      1.0,      0.00, !  !END!
382 ! X =    1856.078,      -300.525,      1.0,      0.00, !  !END!
383 ! X =    1856.812,      -300.355,      1.0,      0.00, !  !END!
384 ! X =    1857.545,      -300.185,      1.0,      0.00, !  !END!
385 ! X =    1859.745,      -299.674,      0.0,      0.00, !  !END!
386 ! X =    1860.479,      -299.503,      1.0,      0.00, !  !END!
387 ! X =    1861.212,      -299.332,      1.0,      0.00, !  !END!
388 ! X =    1843.399,      -302.509,      0.0,      0.00, !  !END!
389 ! X =    1844.133,      -302.340,      1.0,      0.00, !  !END!
390 ! X =    1844.867,      -302.171,      1.0,      0.00, !  !END!
391 ! X =    1848.535,      -301.324,      0.0,      0.00, !  !END!
392 ! X =    1849.268,      -301.155,      1.0,      0.00, !  !END!
393 ! X =    1856.603,      -299.456,      1.0,      0.00, !  !END!
394 ! X =    1857.336,      -299.286,      1.0,      0.00, !  !END!
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395 ! X =    1858.803,      -298.945,      1.0,      0.00, !  !END!
396 ! X =    1859.536,      -298.774,      1.0,      0.00, !  !END!
397 ! X =    1848.327,      -300.425,      1.0,      0.00, !  !END!
398 ! X =    1856.394,      -298.556,      1.0,      0.00, !  !END!
399 ! X =    1858.594,      -298.045,      1.0,      0.00, !  !END!
400 ! X =    1859.327,      -297.875,      1.0,      0.00, !  !END!
401 ! X =    1859.118,      -296.976,      1.0,      0.00, !  !END!
402 ! X =    1859.851,      -296.805,      1.0,      0.00, !  !END!
403 ! X =    1504.741,      31.554,      916.0,      0.00, !  !END!
404 ! X =    1505.444,      31.692,      1069.0,      0.00, !  !END!
405 ! X =    1506.147,      31.830,      1175.0,      0.00, !  !END!
406 ! X =    1506.850,      31.968,      1216.0,      0.00, !  !END!
407 ! X =    1503.860,      32.320,      824.0,      0.00, !  !END!
408 ! X =    1504.563,      32.458,      952.0,      0.00, !  !END!
409 ! X =    1505.266,      32.596,      1049.0,      0.00, !  !END!
410 ! X =    1505.969,      32.734,      1127.0,      0.00, !  !END!
411 ! X =    1506.672,      32.872,      1171.0,      0.00, !  !END!
412 ! X =    1507.375,      33.010,      1219.0,      0.00, !  !END!
413 ! X =    1508.078,      33.149,      1202.0,      0.00, !  !END!
414 ! X =    1502.980,      33.086,      1058.0,      0.00, !  !END!
415 ! X =    1503.683,      33.224,      967.0,      0.00, !  !END!
416 ! X =    1504.386,      33.362,      828.0,      0.00, !  !END!
417 ! X =    1505.089,      33.500,      851.0,      0.00, !  !END!
418 ! X =    1505.792,      33.638,      856.0,      0.00, !  !END!
419 ! X =    1506.494,      33.776,      974.0,      0.00, !  !END!
420 ! X =    1507.197,      33.914,      1077.0,      0.00, !  !END!
421 ! X =    1507.900,      34.053,      1148.0,      0.00, !  !END!
422 ! X =    1508.603,      34.191,      1188.0,      0.00, !  !END!
423 ! X =    1503.506,      34.128,      1116.0,      0.00, !  !END!
424 ! X =    1504.208,      34.266,      1004.0,      0.00, !  !END!
425 ! X =    1504.911,      34.404,      1097.0,      0.00, !  !END!
426 ! X =    1505.614,      34.542,      994.0,      0.00, !  !END!
427 ! X =    1506.317,      34.680,      954.0,      0.00, !  !END!
428 ! X =    1507.019,      34.818,      930.0,      0.00, !  !END!
429 ! X =    1507.722,      34.957,      1110.0,      0.00, !  !END!
430 ! X =    1508.425,      35.095,      1163.0,      0.00, !  !END!
431 ! X =    1503.328,      35.032,      1145.0,      0.00, !  !END!
432 ! X =    1504.031,      35.170,      1112.0,      0.00, !  !END!
433 ! X =    1504.734,      35.308,      1100.0,      0.00, !  !END!
434 ! X =    1505.436,      35.446,      1073.0,      0.00, !  !END!
435 ! X =    1506.139,      35.584,      1127.0,      0.00, !  !END!
436 ! X =    1506.842,      35.723,      1005.0,      0.00, !  !END!
437 ! X =    1507.544,      35.861,      1050.0,      0.00, !  !END!
438 ! X =    1508.247,      35.999,      1135.0,      0.00, !  !END!
439 ! X =    1508.949,      36.137,      1211.0,      0.00, !  !END!
440 ! X =    1503.151,      35.937,      1147.0,      0.00, !  !END!
441 ! X =    1503.853,      36.075,      1127.0,      0.00, !  !END!
442 ! X =    1504.556,      36.212,      1123.0,      0.00, !  !END!
443 ! X =    1505.259,      36.350,      1108.0,      0.00, !  !END!
```

```
444 ! X =    1505.961,      36.489,      1126.0,      0.00, !  !END!
445 ! X =    1506.664,      36.627,      1015.0,      0.00, !  !END!
446 ! X =    1507.366,      36.765,      1144.0,      0.00, !  !END!
447 ! X =    1508.069,      36.903,      1109.0,      0.00, !  !END!
448 ! X =    1508.771,      37.041,      1201.0,      0.00, !  !END!
449 ! X =    1503.676,      36.979,      1154.0,      0.00, !  !END!
450 ! X =    1504.379,      37.117,      1128.0,      0.00, !  !END!
451 ! X =    1505.081,      37.255,      1135.0,      0.00, !  !END!
452 ! X =    1505.784,      37.393,      1158.0,      0.00, !  !END!
453 ! X =    1506.486,      37.531,      1090.0,      0.00, !  !END!
454 ! X =    1507.189,      37.669,      1153.0,      0.00, !  !END!
455 ! X =    1507.891,      37.807,      1157.0,      0.00, !  !END!
456 ! X =    1508.593,      37.945,      1166.0,      0.00, !  !END!
457 ! X =    1509.296,      38.084,      1168.0,      0.00, !  !END!
458 ! X =    1503.499,      37.883,      1137.0,      0.00, !  !END!
459 ! X =    1504.201,      38.021,      1127.0,      0.00, !  !END!
460 ! X =    1504.903,      38.159,      1156.0,      0.00, !  !END!
461 ! X =    1505.606,      38.297,      1158.0,      0.00, !  !END!
462 ! X =    1506.308,      38.435,      1110.0,      0.00, !  !END!
463 ! X =    1507.011,      38.573,      1097.0,      0.00, !  !END!
464 ! X =    1508.415,      38.849,      1159.0,      0.00, !  !END!
465 ! X =    1509.118,      38.988,      1188.0,      0.00, !  !END!
466 ! X =    1504.023,      38.925,      1128.0,      0.00, !  !END!
467 ! X =    1504.726,      39.063,      1157.0,      0.00, !  !END!
468 ! X =    1479.243,      23.778,      1127.0,      0.00, !  !END!
469 ! X =    1479.947,      23.914,      1088.0,      0.00, !  !END!
470 ! X =    1480.651,      24.050,      1006.0,      0.00, !  !END!
471 ! X =    1481.354,      24.185,      973.0,      0.00, !  !END!
472 ! X =    1482.058,      24.321,      945.0,      0.00, !  !END!
473 ! X =    1482.762,      24.457,      1043.0,      0.00, !  !END!
474 ! X =    1479.069,      24.683,      1139.0,      0.00, !  !END!
475 ! X =    1479.772,      24.819,      1090.0,      0.00, !  !END!
476 ! X =    1480.476,      24.954,      1071.0,      0.00, !  !END!
477 ! X =    1481.180,      25.090,      974.0,      0.00, !  !END!
478 ! X =    1481.883,      25.226,      1017.0,      0.00, !  !END!
479 ! X =    1482.587,      25.362,      1072.0,      0.00, !  !END!
480 ! X =    1483.291,      25.498,      1095.0,      0.00, !  !END!
481 ! X =    1481.005,      25.995,      1068.0,      0.00, !  !END!
482 ! X =    1481.709,      26.131,      938.0,      0.00, !  !END!
483 ! X =    1482.412,      26.267,      914.0,      0.00, !  !END!
484 ! X =    1483.116,      26.403,      1016.0,      0.00, !  !END!
485 ! X =    1483.819,      26.539,      1079.0,      0.00, !  !END!
486 ! X =    1480.127,      26.764,      1006.0,      0.00, !  !END!
487 ! X =    1480.830,      26.900,      975.0,      0.00, !  !END!
488 ! X =    1481.534,      27.035,      1034.0,      0.00, !  !END!
489 ! X =    1482.237,      27.171,      960.0,      0.00, !  !END!
490 ! X =    1482.941,      27.307,      929.0,      0.00, !  !END!
491 ! X =    1483.644,      27.443,      1091.0,      0.00, !  !END!
492 ! X =    1484.348,      27.579,      1084.0,      0.00, !  !END!
```

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493 ! X =    1479.249,      27.533,      1120.0,      0.00, !  !END!
494 ! X =    1479.952,      27.669,      1065.0,      0.00, !  !END!
495 ! X =    1480.656,      27.804,      1058.0,      0.00, !  !END!
496 ! X =    1481.359,      27.940,      1036.0,      0.00, !  !END!
497 ! X =    1482.063,      28.076,      1006.0,      0.00, !  !END!
498 ! X =    1482.766,      28.212,      916.0,      0.00, !  !END!
499 ! X =    1483.469,      28.348,      895.0,      0.00, !  !END!
500 ! X =    1484.173,      28.484,      951.0,      0.00, !  !END!
501 ! X =    1479.075,      28.438,      1148.0,      0.00, !  !END!
502 ! X =    1479.778,      28.573,      1100.0,      0.00, !  !END!
503 ! X =    1480.481,      28.709,      1056.0,      0.00, !  !END!
504 ! X =    1481.184,      28.845,      1017.0,      0.00, !  !END!
505 ! X =    1481.888,      28.981,      939.0,      0.00, !  !END!
506 ! X =    1482.591,      29.117,      912.0,      0.00, !  !END!
507 ! X =    1483.294,      29.253,      853.0,      0.00, !  !END!
508 ! X =    1483.997,      29.389,      937.0,      0.00, !  !END!
509 ! X =    1484.701,      29.525,      1039.0,      0.00, !  !END!
510 ! X =    1478.900,      29.342,      1126.0,      0.00, !  !END!
511 ! X =    1479.603,      29.478,      1092.0,      0.00, !  !END!
512 ! X =    1480.307,      29.614,      1068.0,      0.00, !  !END!
513 ! X =    1481.010,      29.749,      1038.0,      0.00, !  !END!
514 ! X =    1481.713,      29.885,      986.0,      0.00, !  !END!
515 ! X =    1482.416,      30.021,      931.0,      0.00, !  !END!
516 ! X =    1483.119,      30.157,      829.0,      0.00, !  !END!
517 ! X =    1483.822,      30.293,      954.0,      0.00, !  !END!
518 ! X =    1484.526,      30.429,      1065.0,      0.00, !  !END!
519 ! X =    1485.229,      30.565,      1096.0,      0.00, !  !END!
520 ! X =    1479.429,      30.383,      1064.0,      0.00, !  !END!
521 ! X =    1480.132,      30.518,      1034.0,      0.00, !  !END!
522 ! X =    1480.835,      30.654,      979.0,      0.00, !  !END!
523 ! X =    1481.538,      30.790,      942.0,      0.00, !  !END!
524 ! X =    1482.241,      30.926,      870.0,      0.00, !  !END!
525 ! X =    1482.944,      31.062,      830.0,      0.00, !  !END!
526 ! X =    1483.647,      31.198,      941.0,      0.00, !  !END!
527 ! X =    1484.350,      31.334,      1038.0,      0.00, !  !END!
528 ! X =    1485.053,      31.470,      1104.0,      0.00, !  !END!
529 ! X =    1485.757,      31.606,      1132.0,      0.00, !  !END!
530 ! X =    1478.551,      31.152,      986.0,      0.00, !  !END!
531 ! X =    1479.254,      31.287,      1032.0,      0.00, !  !END!
532 ! X =    1479.957,      31.423,      1006.0,      0.00, !  !END!
533 ! X =    1480.660,      31.559,      1022.0,      0.00, !  !END!
534 ! X =    1481.363,      31.695,      1003.0,      0.00, !  !END!
535 ! X =    1482.066,      31.831,      941.0,      0.00, !  !END!
536 ! X =    1482.769,      31.966,      830.0,      0.00, !  !END!
537 ! X =    1483.472,      32.102,      1012.0,      0.00, !  !END!
538 ! X =    1484.175,      32.239,      1036.0,      0.00, !  !END!
539 ! X =    1484.878,      32.375,      1073.0,      0.00, !  !END!
540 ! X =    1485.581,      32.511,      1098.0,      0.00, !  !END!
541 ! X =    1486.284,      32.647,      1095.0,      0.00, !  !END!
```

```
542 ! X =    1479.080,      32.192,      1064.0,      0.00, !  !END!
543 ! X =    1479.783,      32.328,      1067.0,      0.00, !  !END!
544 ! X =    1480.486,      32.464,      1050.0,      0.00, !  !END!
545 ! X =    1481.189,      32.599,      929.0,      0.00, !  !END!
546 ! X =    1481.891,      32.735,      781.0,      0.00, !  !END!
547 ! X =    1482.594,      32.871,      934.0,      0.00, !  !END!
548 ! X =    1483.297,      33.007,      1027.0,      0.00, !  !END!
549 ! X =    1484.000,      33.143,      1056.0,      0.00, !  !END!
550 ! X =    1484.703,      33.279,      1097.0,      0.00, !  !END!
551 ! X =    1485.406,      33.415,      1087.0,      0.00, !  !END!
552 ! X =    1486.109,      33.552,      878.0,      0.00, !  !END!
553 ! X =    1478.905,      33.097,      1041.0,      0.00, !  !END!
554 ! X =    1479.608,      33.232,      1040.0,      0.00, !  !END!
555 ! X =    1480.311,      33.368,      946.0,      0.00, !  !END!
556 ! X =    1481.014,      33.504,      818.0,      0.00, !  !END!
557 ! X =    1481.717,      33.640,      737.0,      0.00, !  !END!
558 ! X =    1482.419,      33.776,      997.0,      0.00, !  !END!
559 ! X =    1483.122,      33.912,      1044.0,      0.00, !  !END!
560 ! X =    1483.825,      34.048,      1037.0,      0.00, !  !END!
561 ! X =    1484.528,      34.184,      1034.0,      0.00, !  !END!
562 ! X =    1485.231,      34.320,      1065.0,      0.00, !  !END!
563 ! X =    1485.933,      34.456,      816.0,      0.00, !  !END!
564 ! X =    1486.636,      34.592,      695.0,      0.00, !  !END!
565 ! X =    1479.433,      34.137,      1068.0,      0.00, !  !END!
566 ! X =    1480.136,      34.273,      1039.0,      0.00, !  !END!
567 ! X =    1480.839,      34.409,      803.0,      0.00, !  !END!
568 ! X =    1481.542,      34.544,      835.0,      0.00, !  !END!
569 ! X =    1482.244,      34.680,      1033.0,      0.00, !  !END!
570 ! X =    1482.947,      34.816,      1048.0,      0.00, !  !END!
571 ! X =    1483.650,      34.952,      949.0,      0.00, !  !END!
572 ! X =    1484.353,      35.088,      860.0,      0.00, !  !END!
573 ! X =    1485.055,      35.225,      1006.0,      0.00, !  !END!
574 ! X =    1485.758,      35.361,      725.0,      0.00, !  !END!
575 ! X =    1479.259,      35.042,      933.0,      0.00, !  !END!
576 ! X =    1479.961,      35.178,      921.0,      0.00, !  !END!
577 ! X =    1480.664,      35.313,      774.0,      0.00, !  !END!
578 ! X =    1481.367,      35.449,      775.0,      0.00, !  !END!
579 ! X =    1482.069,      35.585,      862.0,      0.00, !  !END!
580 ! X =    1482.772,      35.721,      832.0,      0.00, !  !END!
581 ! X =    1483.475,      35.857,      789.0,      0.00, !  !END!
582 ! X =    1479.787,      36.082,      763.0,      0.00, !  !END!
583 ! X =    1480.489,      36.218,      757.0,      0.00, !  !END!
584 ! X =    1481.192,      36.354,      816.0,      0.00, !  !END!
585 ! X =    1481.894,      36.490,      807.0,      0.00, !  !END!
586 ! X =    1482.597,      36.626,      688.0,      0.00, !  !END!
587 ! X =    1481.017,      37.258,      1097.0,      0.00, !  !END!
588 ! X =    1481.720,      37.394,      990.0,      0.00, !  !END!
589 ! X =    1482.422,      37.530,      979.0,      0.00, !  !END!
```

---

a
Data for each receptor are treated as a separate input subgroup
and therefore must end with an input group terminator.

b
Receptor height above ground is optional. If no value is entered,
the receptor is placed on the ground.

SAMPLE POSTUTIL INPUT FILE

HONYWLVAUT02.INP
12-KM SCREENING ANALYSIS YEAR 2002

```
HONEYWELL HOPEWELL VIRGINIA
BART APPLICABILITY ANALYSIS - 12 KM SCREENING
JRF/SHEN/DS/OC/SQ ANALYSES
---------------- Run title (3 lines) ------------------------------------------

                    POSTUTIL MODEL CONTROL FILE
                    ---------------------------

-------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

-------------
Subgroup (0a)
-------------

Output Files
------------

 File            Default File Name
 ----            -----------------
 List File       POSTUTIL.LST       ! UTLLST =S:\BART\HONYWLVA\12KM\HONYWLVAUT02.lst   !
 Data File       MODEL.DAT          ! UTLDAT =S:\BART\HONYWLVA\12KM\HONYWLVAUT02.con   !



Input Files
-----------

 A time-varying file of "background" concentrations can be included
 when the ammonia-limiting method (ALM) for setting the HNO3/NO3
 concentration partition is accomplished in 1 step.  This option
 is selected by setting MNITRATE=3 in Input Group 1.
 Species required in the "background" concentration file are:
 SO4, NO3, HNO3 and TNH3 (total NH3 = NH3gaseous + NH3particulate).

 File            Default File Name
 ----            -----------------
 BCKG File       BCKGALM.DAT         * BCKGALM =BCKGALM.DAT     *


 A number of CALPUFF data files may be processed in this application.
 The files may represent individual CALPUFF simulations that were made
 for a specific set of species and/or sources.  Specify the total number
 of CALPUFF runs you wish to combine, and provide the filename for each
 in subgroup 0b.

     Number of CALPUFF data files (NFILES)
```

```
                                    Default: 1       ! NFILES  = 1   !


 Meteorological data files are needed for the HNO3/NO3 partition option.
 Three types of meteorological data files can be used:
       METFM= 0 - CALMET.DAT
       METFM= 1 - 1-D file with RH, Temp and Rhoair timeseries
       METFM= 2 - 2-D files with either Rh, Temp or Rhoair in each
                  (3 2 D files are needed)
      The default is to use CALMET.DAT files.

                                    Default: 0       ! METFM   = 0   !


 Multiple meteorological data files may be used in sequence to span the
 processing period.  Specify the number of time-period files (NMET) that
 you need to use, and provide a filename for each in subgroup 0b.
 - NMET is 0 if no meteorological files are provided
 - NMET is 1 if METFM=1 (multiple file feature is not available)
 - NMET is 1 or more if METFM=0 or 2 (multiple CALMET files or 2DMET files)

     Number of meteorological data file time-periods (NMET)
                                    Default: 0       ! NMET    = 0   !



 All filenames will be converted to lower case if LCFILES = T
 Otherwise, if LCFILES = F, filenames will be converted to UPPER CASE

     Convert filenames to lower case?  Default: T     ! LCFILES = T !
         T = lower case
         F = UPPER CASE

!END!

------------------------------------------------------------
 NOTE: file/path names can be up to 70 characters in length
------------------------------------------------------------

-------------
Subgroup (0b)
-------------

NMET CALMET Data Files (METFM=0):

Input File      Default File Name
----------      -----------------
   1            MET.DAT            * UTLMET =CALMET.DAT  * *END*
```

```
NMET 1-D Data Files (METFM=1):

Input File      Default File Name
----------      -----------------
   1            MET_1D.DAT         * MET1D   = MET_1D.DAT * *END*


NMET 2-D Data Files of Each Type (METFM=2):

Input File      Default File Name
----------      -----------------
   1            RHUMD.DAT          * M2DRHU  = RELHUM.DAT * *END*
   1            TEMP.DAT           * M2DTMP  = TEMP.DAT   * *END*
   1            RHOAIR.DAT         * M2DRHO  = RHOAIR.DAT * *END*


NFILES CALPUFF Data Files:

Input File      Default File Name
----------      -----------------
   1            CALPUFF.DAT        ! MODDAT =S:\BART\HONYWLVA\12KM\HONYWLVA02.con ! !END!


-------------
Note:  provide NMET lines of the form   * UTLMET = name * *END*

                                    or   * MET1D  = name * *END*

                                    or   * M2DRHU = name * *END*
                                  (and)  * M2DTMP = name * *END*
                                  (and)  * M2DRHO = name * *END*

       and NFILES lines of the form     * MODDAT = name * *END*

       where the * should be replaced with an exclamation point,
       the special delimiter character.


------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

     Starting date:    Year  (ISYR) --    No default   ! ISYR  =  2002 !
                       Month (ISMO) --    No default   ! ISMO  = 1    !
                       Day   (ISDY) --    No default   ! ISDY  = 1    !
                       Hour  (ISHR) --    No default   ! ISHR  = 1    !
```

```
    Number of periods to process
                              (NPER) -- No default   ! NPER  = 8760   !

    Number of species to process from CALPUFF runs
                           (NSPECINP) -- No default   ! NSPECINP = 20 !

    Number of species to write to output file
                           (NSPECOUT) -- No default   ! NSPECOUT = 10 !

    Number of species to compute from those modeled
    (must be no greater than NSPECOUT)
                           (NSPECCMP) -- No default   ! NSPECCMP = 4 !


When multiple files are used, a species name may appear in more than
one file.  Data for this species will be summed (appropriate if the
CALPUFF runs use different source groups).  If this summing is not
appropriate, remove duplicate species from the file(s).

    Stop run if duplicate species names
    are found? (MDUPLCT)           Default: 0       ! MDUPLCT  =  0  !
       0 = no  (i.e., duplicate species are summed)
       1 = yes (i.e., run is halted)

Data for each species in a CALPUFF data file may also be scaled as
they are read.  This can be done to alter the emission rate of all
sources that were modeled in a particular CALPUFF application.
The scaling factor for each species is entered in Subgroup (2d), for
each file for which scaling is requested.

    Number of CALPUFF data files that will be scaled
    (must be no greater than NFILES)
    (NSCALED)                      Default: 0       ! NSCALED = 0 !


Ammonia-Limiting Method Option to recompute the HNO3/NO3 concentration
partition prior to performing other actions is controlled by MNITRATE.
This option will NOT alter any deposition fluxes contained in the CALPUFF
file(s).  Three partition selections are provided.  The first two are
typically used in sequence (POSTUTIL is run more than once).  The first
selection (MNITRATE=1) computes the partition for the TOTAL (all sources)
concentration fields (SO4, NO3, HNO3; NH3), and the second (MNITRATE=2)
uses this partition (from the previous application of POSTUTIL) to
compute the partition for individual source groups.  The third selection
(MNITRATE=3) can be used instead in a single POSTUTIL application if a
file of background concentrations is provided (BCKGALM in Input Group 0).

Required information for MNITRATE=1 includes:
         species NO3, HNO3, and SO4
```

```
          NH3 concentration(s)
          met. data file for RH and T

 Required information for MNITRATE=2 includes:
          species NO3 and HNO3 for a source group
          species NO3ALL and HNO3ALL for all source groups, properly
          partitioned

 Required information for MNITRATE=3 includes:
          species NO3, HNO3, and SO4 for a source group
          species NO3, HNO3, SO4 and TNH3 from the background BCKGALM file
          If TNH3 is not in the background BCKGALM file, monthly TNH3
          concentrations are used (BCKTNH3)
          TNH3= total NH3 = NH3gaseous+NH3particulate

     Recompute the HNO3/NO3 partition for concentrations?
     (MNITRATE)                    Default: 0       ! MNITRATE  =  0  !
        0 = no
        1 = yes, for all sources combined
        2 = yes, for a source group
        3 = yes, ALM application in one step


 SOURCE OF AMMONIA:

 Ammonia may be available as a modeled species in the CALPUFF files,
 and it may or may not be appropriate to use it for repartitioning NO3/HNO3
 (in option MNITRATE=1 or MNITRATE=3).  Its use is contolled by NH3TYP.
 When NH3 is listed as a processed species in Subgroup (2a), as one of
 the NSPECINP ASPECI entries, and the right option is chosen for NH3TYP,
 the NH3 modeled values from the CALPUFF concentration files will be used
 in the chemical equilibrium calculation.

 NH3TYP also controls when monthly background ammonia values are used.  Both
 gaseous (NH3) and total (TNH3=NH3gaseous+NH3particulate) ammonia can be provided
 monthly as BCKNH3/BCKTNH3.

     What is the input source of Ammonia?
     (NH3TYP)                      No Default       ! NH3TYP = 3  !
        0 = No background will be used.
            ONLY NH3 or TNH3 from the concentration
            files listed in Subgroup (2a&2b) as
            a processed species will be used.
            (Cannot be used with MNITRATE=3)

        1 = NH3 Monthly averaged background (BCKNH3)
            listed below will be added to NH3 from
            concentration files listed in Subgroup (2a)
```

2 = NH3 from background concentration file BCKGALM
will be added to NH3 from concentration files
listed in Subgroup (2a&2b)
(ONLY possible for MNITRATE=3)

3 = NH3 Monthly averaged background (BCKNH3)
listed below will be used alone.

4 = NH3 from background concentration file BCKGALM
will be used alone
(ONLY possible for MNITRATE=3)

OPTION	NH3 or TNH3 CONC	BCKNH3 or BCKTNH3	TNH3/BCKGALM or BCKTNH3
0	X	0	0
1	X	X	0
2	X	0	X
3	0	X	0
4	0	0	X

Default monthly (12 values) background ammonia concentration (ppb)
used for HNO3/NO3 partition (need to choose one or the other):

Gaseous NH3 (BCKNH3) Default: -999
! BCKNH3 = 12*0.5 !

Total TNH3 (BCKTNH3) Default: -999
* BCKTNH3 = 1., 1., 1., 1.1, 1.4, 1.3, 1.3, 1.2, 4*1. *

If a single value is entered, this is used for all 12 months.
Month 1 is JANUARY, Month 12 is DECEMBER.

!END!

INPUT GROUP: 2 -- Species Processing Information

Subgroup (2a)

The following NSPECINP species will be processed:

```
! ASPECI =           SO2 !         !END!
! ASPECI =           SO4 !         !END!
! ASPECI =           NOX !         !END!
! ASPECI =          HNO3 !         !END!
! ASPECI =           NO3 !         !END!
! ASPECI =        POC081 !         !END!
! ASPECI =        POC056 !         !END!
! ASPECI =        PIC081 !         !END!
! ASPECI =        PIC056 !         !END!
! ASPECI =        PMC800 !         !END!
! ASPECI =        PMC425 !         !END!
! ASPECI =        PMF187 !         !END!
! ASPECI =        PMF112 !         !END!
! ASPECI =        PMF081 !         !END!
! ASPECI =        PMF056 !         !END!
! ASPECI =         EC187 !         !END!
! ASPECI =         EC112 !         !END!
! ASPECI =         EC081 !         !END!
! ASPECI =         EC056 !         !END!
! ASPECI =           NH3 !         !END!
```

Subgroup (2b)

The following NSPECOUT species will be written:

```
! ASPECO =            SO2 !         !END!
! ASPECO =            SO4 !         !END!
! ASPECO =            NOX !         !END!
! ASPECO =           HNO3 !         !END!
! ASPECO =            NO3 !         !END!
! ASPECO =             EC !         !END!
! ASPECO =           SOIL !         !END!
! ASPECO =            SOA !         !END!
! ASPECO =            PMC !         !END!
! ASPECO =            NH3 !         !END!
```

Subgroup (2c)

The following NSPECCMP species will be computed by scaling and summing one or more of the processed input species. Identify the name(s) of the computed species and provide the scaling factors for each of the NSPECINP input species (NSPECCMP groups of NSPECINP+1 lines each):

```
! CSPECCMP  =       EC  !
!    EC187  =   1.0000  !
!    EC112  =   1.0000  !
!    EC081  =   1.0000  !
!    EC056  =   1.0000  !
!END!

! CSPECCMP  =     SOIL  !
!   PMF187  =   1.0000  !
!   PMF112  =   1.0000  !
!   PMF081  =   1.0000  !
!   PMF056  =   1.0000  !
!   PIC081  =   1.0000  !
!   PIC056  =   1.0000  !
!END!

! CSPECCMP  =      SOA  !
!   POC081  =   1.0000  !
!   POC056  =   1.0000  !
!END!

! CSPECCMP  =      PMC  !
!   PMC800  =   1.0000  !
!   PMC425  =   1.0000  !
!END!


-------------
Subgroup (2d)
-------------

  Each species in NSCALED CALPUFF data files may be scaled before being
  processed (e.g., to change the emission rate for all sources modeled
  in the run that produced a data file).  For each file, identify the
  file name and then provide the name(s) of the scaled species and the
  corresponding scaling factors (A,B where x' = Ax+B).

              A(Default=1.0)      B(Default=0.0)
              --------------      --------------

* MODDAT =NOFILES.DAT    *
*     SO2  =      1.1,                0.0   *
*     SO4  =      1.5,                0.0   *
*    HNO3  =      0.8,                0.0   *
*     NO3  =      0.1,                0.0   *
*END*
```

SAMPLE CALPOST INPUT FILE

HONYWLVAVANSI02.INP
12-KM SCREENING ANALYSIS YEAR 2002
SHENANDOAH ANNUAL AVERAGE NATURAL BACKGROUND

```
HONEYWELL HOPEWELL VIRGINIA
BART APPLICABILITY ANALYSIS - 12 KM SCREENING
SHENANDOAH VISTAS ANNUAL AVERAGE NATURAL BACKGROUND
---------------- Run title (3 lines) ----------------------------------------

                    CALPOST MODEL CONTROL FILE
                    --------------------------

-------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

Input Files
-----------

File                       Default File Name
----                       -----------------
Conc/Dep Flux File         MODEL.DAT          ! MODDAT =S:\BART\HONYWLVA\12KM\HONYWLVAUT02.con   !
Relative Humidity File     VISB.DAT           * VISDAT =   *
Background Data File       BACK.DAT           * BACKDAT =  *
Transmissometer or         VSRN.DAT           * VSRDAT =   *
Nephelometer Data File      or
DATSAV Weather Data File    or
Prognostic Weather  File

Output Files
------------

File                       Default File Name
----                       -----------------
List File                  CALPOST.LST        ! PSTLST =S:\BART\HONYWLVA\12KM\HONYWLVAVANSH02.lst   !

Pathname for Timeseries Files   (blank)       * TSPATH =   *
(activate with exclamation points only if
providing NON-BLANK character string)

Pathname for Plot Files   (blank)             * PLPATH =   *
(activate with exclamation points only if
 providing NON-BLANK character string)

User Character String (U) to augment default filenames
(activate with exclamation points only if
 providing NON-BLANK character string)

Timeseries          TSERIES ASPEC ttHR CONC TSUNAM.DAT
Peak Value          PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT

                                           * TSUNAM =   *
```

```
Top Nth Rank Plot   RANK(ALL) ASPEC ttHR CONC TUNAM.DAT
                or  RANK(ii)_ASPEC_ttHR_CONC_TUNAM.GRD

                                          * TUNAM =   *

Exceedance Plot      EXCEED ASPEC ttHR CONC XUNAM.DAT
                 or  EXCEED_ASPEC_ttHR_CONC_XUNAM.GRD

                                          * XUNAM =   *

Echo Plot
(Specific Days)
           yyyy Mmm Ddd hh00(UTCszzzz) L00 ASPEC ttHR CONC.DAT
     or    yyyy_Mmm_Ddd_hh00(UTCszzzz)_L00_ASPEC_ttHR_CONC.GRD


Visibility Plot      DAILY_VISIB_VUNAM.DAT   * VUNAM =   *
(Daily Peak Summary)


Auxiliary Output Files
----------------------

File                      Default File Name
----                      -----------------
Visibility Change         DELVIS.DAT         ! DVISDAT =S:\BART\HONYWLVA\12KM\HONYWLVAVANSH02.del   !


--------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case               ! LCFILES = T !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 132 characters in length
NOTE: (2) Filenames for ALL PLOT and TIMESERIES FILES are constructed
          using a template that includes a pathname, user-supplied
          character(s), and context-specific strings, where
             ASPEC = Species Name
              CONC = CONC Or WFLX Or DFLX Or TFLX
                tt = Averaging Period (e.g. 03)
                ii = Rank (e.g. 02)
                hh = Hour(ending) in LST
             szzzz = Base time zone shift from UTC (EST is -0500)
              yyyy = Year(LST)
                mm = Month(LST)
                dd = day of month (LST)
          are determined internally based on selections made below.
          If a path or user-supplied character(s) are supplied, each
```

```
          must contain at least 1 non-blank character.

!END!
------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

     Option to run all periods found
     in the met. file(s)  (METRUN)        Default: 0   ! METRUN =   1  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in CALPUFF data file(s)

     Starting date:    Year  (ISYR) --    No default   ! ISYR  =  2002   !
     (used only if     Month (ISMO) --    No default   ! ISMO  =  0   !
      METRUN = 0)      Day   (ISDY) --    No default   ! ISDY  =  0   !
                       Hour  (ISHR) --    No default   ! ISHR  =  0   !

     Number of hours to process (NHRS) -- No default   ! NHRS  =  8760   !

     Process every hour of data?(NREP) -- Default: 1   ! NREP  =  1  !
      (1 = every hour processed,
       2 = every 2nd hour processed,
       5 = every 5th hour processed, etc.)

Species & Concentration/Deposition Information
----------------------------------------------

      Species to process (ASPEC)       -- No default   ! ASPEC = VISIB  !
      (ASPEC = VISIB for visibility processing)

      Layer/deposition code (ILAYER)   -- Default: 1   ! ILAYER =  1  !
        '1'  for CALPUFF concentrations,
        '-1' for dry deposition fluxes,
        '-2' for wet deposition fluxes,
        '-3' for wet+dry deposition fluxes.

      Scaling factors of the form:     -- Defaults:    ! A =  0.0    !
            X(new) = X(old) * A + B         A = 0.0    ! B =  0.0    !
        (NOT applied if A = B = 0.0)        B = 0.0

      Add Hourly Background Concentrations/Fluxes?
                             (LBACK)  -- Default: F   ! LBACK =  F !

Source information
------------------

  Option to process source contributions:
```

```
         0 =  Process only total reported contributions
         1 =  Sum all individual source contributions and process
         2 =  Run in TRACEBACK mode to identify source
              contributions at a SINGLE receptor
                          (MSOURCE) -- Default: 0   ! MSOURCE =  0  !

Receptor information
--------------------

  Gridded receptors processed?    (LG) -- Default: F   ! LG  = F  !
  Discrete receptors processed?   (LD) -- Default: F   ! LD  = T  !
  CTSG Complex terrain receptors processed?
                                 (LCT) -- Default: F   ! LCT = F  !

--Report results by DISCRETE receptor RING?
  (only used when LD = T)     (LDRING) -- Default: F   ! LDRING = F  !

--Select range of DISCRETE receptors (only used when LD = T):

  Select ALL DISCRETE receptors by setting NDRECP flag to -1;
                               OR
  Select SPECIFIC DISCRETE receptors by entering a flag (0,1) for each
     0 = discrete receptor not processed
     1 = discrete receptor processed
  using repeated value notation to select blocks of receptors:
     23*1, 15*0, 12*1
  Flag for all receptors after the last one assigned is set to 0
  (NDRECP) -- Default: -1
 ! NDRECP = 298*1, 52*0, 52*0, 65*0, 122*0 !


--Select range of GRIDDED receptors (only used when LG = T):

       X index of LL corner (IBGRID) -- Default: -1     ! IBGRID = -1  !
           (-1 OR 1 <= IBGRID <= NX)

       Y index of LL corner (JBGRID) -- Default: -1     ! JBGRID = -1  !
           (-1 OR 1 <= JBGRID <= NY)

       X index of UR corner (IEGRID) -- Default: -1     ! IEGRID = -1  !
           (-1 OR 1 <= IEGRID <= NX)

       Y index of UR corner (JEGRID) -- Default: -1     ! JEGRID = -1  !
           (-1 OR 1 <= JEGRID <= NY)

  Note: Entire grid is processed if IBGRID=JBGRID=IEGRID=JEGRID=-1


--Specific gridded receptors can also be excluded from CALPOST
```

```
  processing by filling a processing grid array with 0s and 1s.  If the
  processing flag for receptor index (i,j) is 1 (ON), that receptor
  will be processed if it lies within the range delineated by IBGRID,
  JBGRID,IEGRID,JEGRID and if LG=T. If it is 0 (OFF), it will not be
  processed in the run.  By default, all array values are set to 1 (ON).

  Number of gridded receptor rows provided in Subgroup (1a) to
  identify specific gridded receptors to process
                          (NGONOFF) -- Default: 0      ! NGONOFF =  0  !

!END!


--------------
Subgroup (1a) -- Specific gridded receptors included/excluded
--------------

    Specific gridded receptors are excluded from CALPOST processing
    by filling a processing grid array with 0s and 1s.  A total of
    NGONOFF lines are read here.  Each line corresponds to one 'row'
    in the sampling grid, starting with the NORTHERNMOST row that
    contains receptors that you wish to exclude, and finishing with
    row 1 to the SOUTH (no intervening rows may be skipped).  Within
    a row, each receptor position is assigned either a 0 or 1,
    starting with the westernmost receptor.
       0 = gridded receptor not processed
       1 = gridded receptor processed

    Repeated value notation may be used to select blocks of receptors:
       23*1, 15*0, 12*1

    Because all values are initially set to 1, any receptors north of
    the first row entered, or east of the last value provided in a row,
    remain ON.

    (NGXRECP) -- Default: 1


-------------------------------------------------------------------------------

INPUT GROUP: 2 -- Visibility Parameters (ASPEC = VISIB)
--------------

    Identify the Base Time Zone for the CALPUFF simulation
                             (BTZONE) -- No default   ! BTZONE = 5.0 !

    Particle growth curve f(RH) for hygroscopic species
                               (MFRH) -- Default: 2   ! MFRH   =  2  !
```

```
         1 =  IWAQM (1998) f(RH) curve (originally used with MVISBK=1)
         2 =  FLAG (2000) f(RH) tabulation
         3 =  EPA (2003) f(RH) tabulation

    Maximum relative humidity (%) used in particle growth curve
                              (RHMAX) -- Default: 98  ! RHMAX  = 98.0 !

    Modeled species to be included in computing the light extinction
     Include SULFATE?          (LVSO4) -- Default: T   ! LVSO4  = T  !
     Include NITRATE?          (LVNO3) -- Default: T   ! LVNO3  = T  !
     Include ORGANIC CARBON?   (LVOC)  -- Default: T   ! LVOC   = T  !
     Include COARSE PARTICLES? (LVPMC) -- Default: T   ! LVPMC  = T  !
     Include FINE PARTICLES?   (LVPMF) -- Default: T   ! LVPMF  = T  !
     Include ELEMENTAL CARBON? (LVEC)  -- Default: T   ! LVEC   = T  !

    And, when ranking for TOP-N, TOP-50, and Exceedance tables,
     Include BACKGROUND?       (LVBK)  -- Default: T   ! LVBK   = T  !

    Species name used for particulates in MODEL.DAT file
                   COARSE    (SPECPMC) -- Default: PMC ! SPECPMC = PMC !
                   FINE      (SPECPMF) -- Default: PMF ! SPECPMF = SOIL !

Extinction Efficiency (1/Mm per ug/m**3)
----------------------------------------
    MODELED particulate species:
               PM  COARSE      (EEPMC) -- Default: 0.6 ! EEPMC  = 0.6 !
               PM  FINE        (EEPMF) -- Default: 1.0 ! EEPMF  = 1.0 !
    BACKGROUND particulate species:
               PM  COARSE    (EEPMCBK) -- Default: 0.6 ! EEPMCBK = 0.6 !
    Other species:
              AMMONIUM SULFATE (EESO4) -- Default: 3.0 ! EESO4  = 3.0 !
              AMMONIUM NITRATE (EENO3) -- Default: 3.0 ! EENO3  = 3.0 !
              ORGANIC CARBON   (EEOC)  -- Default: 4.0 ! EEOC   = 4.0 !
              SOIL             (EESOIL)-- Default: 1.0 ! EESOIL = 1.0 !
              ELEMENTAL CARBON (EEEC)  -- Default: 10. ! EEEC   = 10.0 !

Background Extinction Computation
---------------------------------

    Method used for the 24h-average of percent change of light extinction:
    Hourly ratio of source light extinction / background light extinction
    is averaged?              (LAVER) -- Default: F   ! LAVER = F  !


    Method used for background light extinction
                             (MVISBK) -- Default: 2   ! MVISBK =  6  !

         1 =  Supply single light extinction and hygroscopic fraction
              - Hourly F(RH) adjustment applied to hygroscopic background
```

```
              and modeled sulfate and nitrate
        2 =  Compute extinction from speciated PM measurements (A)
             - Hourly F(RH) adjustment applied to observed and modeled sulfate
               and nitrate
             - F(RH) factor is capped at F(RHMAX)
        3 =  Compute extinction from speciated PM measurements (B)
             - Hourly F(RH) adjustment applied to observed and modeled sulfate
               and nitrate
             - Receptor-hour excluded if RH>RHMAX
             - Receptor-day excluded if fewer than 6 valid receptor-hours
        4 =  Read hourly transmissometer background extinction measurements
             - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
             - Hour excluded if measurement invalid (missing, interference,
               or large RH)
             - Receptor-hour excluded if RH>RHMAX
             - Receptor-day excluded if fewer than 6 valid receptor-hours
        5 =  Read hourly nephelometer background extinction measurements
             - Rayleigh extinction value (BEXTRAY) added to measurement
             - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
             - Hour excluded if measurement invalid (missing, interference,
               or large RH)
             - Receptor-hour excluded if RH>RHMAX
             - Receptor-day excluded if fewer than 6 valid receptor-hours
        6 =  Compute extinction from speciated PM measurements
             - FLAG monthly RH adjustment factor applied to observed and
               modeled sulfate and nitrate
        7 =  Use observed weather or prognostic weather information for
             background extinction during weather events; otherwise, use Method 2
             - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
             - F(RH) factor is capped at F(RHMAX)
             - During observed weather events, compute Bext from visual range
               if using an observed weather data file, or
             - During prognostic weather events, use Bext from the prognostic
               weather file
             - Use Method 2 for hours without a weather event

    Additional inputs used for MVISBK = 1:
    --------------------------------------
     Background light extinction (1/Mm)
                              (BEXTBK) -- No default   ! BEXTBK = 0.0 !
     Percentage of particles affected by relative humidity
                              (RHFRAC) -- No default   ! RHFRAC = 0.0 !

    Additional inputs used for MVISBK = 6:
    --------------------------------------
     Extinction coefficients for hygroscopic species (modeled and
     background) are computed using a monthly RH adjustment factor
     in place of an hourly RH factor (VISB.DAT file is NOT needed).
     Enter the 12 monthly factors here (RHFAC).  Month 1 is January.
```

```
 (RHFAC)  -- No default     ! RHFAC = 3.1, 2.8, 2.8, 2.5,
                                      3.1, 3.4, 3.5, 3.9,
                                      3.9, 3.2, 3.0, 3.1 !

Additional inputs used for MVISBK = 7:
--------------------------------------
 The weather data file (DATSAV abbreviated space-delimited) that
 is identified as VSRN.DAT may contain data for more than one
 station.  Identify the stations that are needed in the order in
 which they will be used to obtain valid weather and visual range.
 The first station that contains valid data for an hour will be
 used.  Enter up to MXWSTA (set in PARAMS file) integer station IDs
 of up to 6 digits each as variable IDWSTA, and enter the corresponding
 time zone for each, as variable TZONE (= UTC-LST).

 A prognostic weather data file with Bext for weather events may be used
 in place of the observed weather file.  Identify this as the VSRN.DAT
 file and use a station ID of IDWSTA = 999999, and TZONE = 0.

 NOTE:  TZONE identifies the time zone used in the dataset.  The
        DATSAV abbreviated space-delimited data usually are prepared
        with UTC time rather than local time, so TZONE is typically
        set to zero.

 (IDWSTA)   -- No default
! IDWSTA = 999999 !
 (TZONE)    -- No default
! TZONE  = 0.0 !

Additional inputs used for MVISBK = 2,3,6,7:
--------------------------------------------
 Background extinction coefficients are computed from monthly
 CONCENTRATIONS of ammonium sulfate (BKSO4), ammonium nitrate (BKNO3),
 coarse particulates (BKPMC), organic carbon (BKOC), soil (BKSOIL), and
 elemental carbon (BKEC).  Month 1 is January.
 (ug/m**3)

 (BKSO4)  -- No default     ! BKSO4 = 0.00, 0.00, 0.00, 0.00,
                                      0.00, 0.00, 0.00, 0.00,
                                      0.00, 0.00, 0.00, 0.00 !
 (BKNO3)  -- No default     ! BKNO3 = 0.00, 0.00, 0.00, 0.00,
                                      0.00, 0.00, 0.00, 0.00,
                                      0.00, 0.00, 0.00, 0.00 !
 (BKPMC)  -- No default     ! BKPMC = 0.00, 0.00, 0.00, 0.00,
                                      0.00, 0.00, 0.00, 0.00,
                                      0.00, 0.00, 0.00, 0.00 !
 (BKOC)   -- No default     ! BKOC  = 0.00, 0.00, 0.00, 0.00,
                                      0.00, 0.00, 0.00, 0.00,
```

```
                                        0.00, 0.00, 0.00, 0.00 !
     (BKSOIL) -- No default     ! BKSOIL= 10.98, 10.98, 10.98, 10.98,
                                        10.98, 10.98, 10.98, 10.98,
                                        10.98, 10.98, 10.98, 10.98 !
     (BKEC)   -- No default     ! BKEC  = 0.00, 0.00, 0.00, 0.00,
                                        0.00, 0.00, 0.00, 0.00,
                                        0.00, 0.00, 0.00, 0.00 !

    Additional inputs used for MVISBK = 2,3,5,6,7:
    ----------------------------------------------
     Extinction due to Rayleigh scattering is added (1/Mm)
                            (BEXTRAY) -- Default: 10.0 ! BEXTRAY = 10.0 !

!END!
-------------------------------------------------------------------------------

INPUT GROUP: 3 -- Output options
--------------

Documentation
-------------

    Documentation records contained in the header of the
    CALPUFF output file may be written to the list file.
    Print documentation image?
                                (LDOC) -- Default: F   !  LDOC = F !

Output Units
------------
    Units for All Output       (IPRTU) -- Default: 1   ! IPRTU =  3   !
                      for           for
                Concentration    Deposition
       1 =         g/m**3         g/m**2/s
       2 =        mg/m**3        mg/m**2/s
       3 =        ug/m**3        ug/m**2/s
       4 =        ng/m**3        ng/m**2/s
       5 =      Odour Units

    Visibility: extinction expressed in 1/Mega-meters (IPRTU is ignored)


Averaging time(s) reported
--------------------------

    1-hr averages           (L1HR) -- Default: T   !   L1HR = F  !

    3-hr averages           (L3HR) -- Default: T   !   L3HR = F  !

    24-hr averages         (L24HR) -- Default: T   !  L24HR = T  !
```

```
    Run-length averages    (LRUNL) -- Default: T   !  LRUNL = F  !

    User-specified averaging time in hours - results for
    an averaging time of NAVG hours are reported for
    NAVG greater than 0:
                           (NAVG) -- Default: 0   !   NAVG =  0  !


Types of tabulations reported
-----------------------------

   1) Visibility: daily visibility tabulations are always reported
                  for the selected receptors when ASPEC = VISIB.
                  In addition, any of the other tabulations listed
                  below may be chosen to characterize the light
                  extinction coefficients.
                  [List file or Plot/Analysis File]


   2) Top 50 table for each averaging time selected
      [List file only]
                           (LT50) -- Default: T   !   LT50 = F  !

   3) Top 'N' table for each averaging time selected
      [List file or Plot file]
                          (LTOPN) -- Default: F   !  LTOPN = T  !

        -- Number of 'Top-N' values at each receptor
           selected (NTOP must be <= 4)
                           (NTOP) -- Default: 4   ! NTOP =  1   !

        -- Specific ranks of 'Top-N' values reported
           (NTOP values must be entered)
                   (ITOP(4) array) -- Default:     ! ITOP =  1   !
                                      1,2,3,4


   4) Threshold exceedance counts for each receptor and each averaging
      time selected
      [List file or Plot file]
                          (LEXCD) -- Default: F   !  LEXCD = F  !

        -- Identify the threshold for each averaging time by assigning a
           non-negative value (output units).

                                   -- Default: -1.0
           Threshold for  1-hr averages   (THRESH1) !  THRESH1 = -1.0  !
           Threshold for  3-hr averages   (THRESH3) !  THRESH3 = -1.0  !
```

```
           Threshold for 24-hr averages  (THRESH24) ! THRESH24 = -1.0  !
           Threshold for NAVG-hr averages (THRESHN) !  THRESHN = -1.0  !


         -- Counts for the shortest averaging period selected can be
            tallied daily, and receptors that experience more than NCOUNT
            counts over any NDAY period will be reported.  This type of
            exceedance violation output is triggered only if NDAY > 0.

            Accumulation period(Days)
                            (NDAY) -- Default: 0   !    NDAY =  0  !
            Number of exceedances allowed
                          (NCOUNT) -- Default: 1   !  NCOUNT =  1  !


   5) Selected day table(s)

      Echo Option -- Many records are written each averaging period
      selected and output is grouped by day
      [List file or Plot file]
                           (LECHO) -- Default: F   !  LECHO = F  !

      Timeseries Option -- Averages at all selected receptors for
      each selected averaging period are written to timeseries files.
      Each file contains one averaging period, and all receptors are
      written to a single record each averaging time.
      [TSERIES_ASPEC_ttHR_CONC TSUNAM.DAT files]
                           (LTIME) -- Default: F   !  LTIME = F  !

      Peak Value Option -- Averages at all selected receptors for
      each selected averaging period are screened and the peak value
      each period is written to timeseries files.
      Each file contains one averaging period.
      [PEAKVAL_ASPEC_ttHR_CONC TSUNAM.DAT files]
                           (LPEAK) -- Default: F   !  LPEAK = F  !

        -- Days selected for output
                       (IECHO(366)) -- Default: 366*0
           ! IECHO  = 366*0  !
           (366 values must be entered)

Plot output options
-------------------

     Plot files can be created for the Top-N, Exceedance, and Echo
     tables selected above.  Two formats for these files are available,
     DATA and GRID.  In the DATA format, results at all receptors are
     listed along with the receptor location [x,y,val1,val2,...].
     In the GRID format, results at only gridded receptors are written,
```

```
     using a compact representation.  The gridded values are written in
     rows (x varies), starting with the most southern row of the grid.
     The GRID format is given the .GRD extension, and includes headers
     compatible with the SURFER(R) plotting software.

     A plotting and analysis file can also be created for the daily
     peak visibility summary output, in DATA format only.

     Generate Plot file output in addition to writing tables
     to List file?
                               (LPLT) -- Default: F   ! LPLT  = F !

     Use GRID format rather than DATA format,
     when available?
                               (LGRD) -- Default: F   ! LGRD  = F !


Auxiliary Output Files (for subsequent analyses)
------------------------------------------------

      Visibility

      A separate output file may be requested that contains the change
      in visibility at each selected receptor when ASPEC = VISIB.  This
      file can be processed to construct visibility measures that are
      not available in CALPOST.

      Output file with the visibility change at each receptor?
                              (MDVIS) -- Default: 0   ! MDVIS  =  1  !

           0 =  Do Not create file
           1 =  Create file of DAILY (24 hour) Delta-Deciview
           2 =  Create file of DAILY (24 hour) Extinction Change (%)
           3 =  Create file of HOURLY Delta-Deciview
           4 =  Create file of HOURLY Extinction Change (%)


Additional Debug Output
-----------------------

   Output selected information to List file
    for debugging?
                             (LDEBUG) -- Default: F  ! LDEBUG  = F !

   Output hourly extinction information to REPORT.HRV?
    (Visibility Method 7)
                            (LVEXTHR) -- Default: F  ! LVEXTHR = F !

!END!
```

CALPUFF BATCH PROCESSING FILE

4-KM REFINED ANALYSES

```
REM HONEYWELL HOPEWELL VIRGINIA
REM BART APPLICABILITY 4 KM REFINED ANALYSIS WITH ALM
REM RAG 8.10.06

REM RUN 2001
CALL CALPUFFL.EXE HONYWLVA01.INP
CALL POSTUTILL.EXE HONYWLVAUT01A1.INP
CALL POSTUTILL.EXE HONYWLVAUT01B1.INP
CALL POSTUTILL.EXE HONYWLVAUT01C1.INP
COPY APPEND01.INP APPEND.INP
CALL APPEND.EXE APPEND.INP
COPY APPEND.LST APPEND01.LST
DEL APPEND.INP
DEL APPEND.LST
CALL POSTUTILL.EXE HONYWLVAUT01.INP
CALL CALPOSTL.EXE HONYWLVAVANJR01.INP
CALL CALPOSTL.EXE HONYWLVAVANSH01.INP
CALL CALPOSTL.EXE HONYWLVAVANSQ01.INP


REM RUN 2002
CALL CALPUFFL.EXE HONYWLVA02.INP
CALL POSTUTILL.EXE HONYWLVAUT02A1.INP
CALL POSTUTILL.EXE HONYWLVAUT02B1.INP
CALL POSTUTILL.EXE HONYWLVAUT02C1.INP
COPY APPEND02.INP APPEND.INP
CALL APPEND.EXE APPEND.INP
COPY APPEND.LST APPEND02.LST
DEL APPEND.INP
DEL APPEND.LST
CALL POSTUTILL.EXE HONYWLVAUT02.INP
CALL CALPOSTL.EXE HONYWLVAVANJR02.INP
CALL CALPOSTL.EXE HONYWLVAVANSH02.INP
CALL CALPOSTL.EXE HONYWLVAVANSQ02.INP


REM RUN 2003
CALL CALPUFFL.EXE HONYWLVA03.INP
CALL POSTUTILL.EXE HONYWLVAUT03A1.INP
CALL POSTUTILL.EXE HONYWLVAUT03B1.INP
CALL POSTUTILL.EXE HONYWLVAUT03C1.INP
COPY APPEND03.INP APPEND.INP
CALL APPEND.EXE APPEND.INP
COPY APPEND.LST APPEND03.LST
DEL APPEND.INP
DEL APPEND.LST
CALL POSTUTILL.EXE HONYWLVAUT03.INP
CALL CALPOSTL.EXE HONYWLVAVANJR03.INP
CALL CALPOSTL.EXE HONYWLVAVANSH03.INP
CALL CALPOSTL.EXE HONYWLVAVANSQ03.INP

PAUSE
EXIT
```

SAMPLE CALPUFF INPUT FILE

HONYWLVA02.INP
4-KM REFINED ANALYSIS YEAR 2002

```
HONEYWELL HOPEWELL VIRGINIA
BART APPLICABILITY ANALYSIS 12 KM SCREENING
JAMES RIVER FACE/SHENANDOAH/DOLLY SODS/OTTER CREEK/SWANQUARTER ANALYSES
---------------- Run title (3 lines) ----------------------------------------

                    CALPUFF MODEL CONTROL FILE
                    --------------------------

--------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names

--------------
Default Name  Type          File Name
------------  ----          ---------
CALMET.DAT    input    * METDAT =              *
    or
ISCMET.DAT    input    * ISCDAT =              *
    or
PLMMET.DAT    input    * PLMDAT =              *
    or
PROFILE.DAT   input    * PRFDAT =              *
SURFACE.DAT   input    * SFCDAT =              *
RESTARTB.DAT  input    * RSTARTB=              *
--------------------------------------------------------------------------------
CALPUFF.LST   output   ! PUFLST =S:\BART\HONYWLVA\12KM\HONYWLVA02.LST  !
CONC.DAT      output   ! CONDAT =S:\BART\HONYWLVA\12KM\HONYWLVA02.CON  !
DFLX.DAT      output   ! DFDAT  =S:\BART\HONYWLVA\12KM\HONYWLVA02.DRY  !
WFLX.DAT      output   ! WFDAT  =S:\BART\HONYWLVA\12KM\HONYWLVA02.WET  !
VISB.DAT      output   ! VISDAT =S:\BART\HONYWLVA\12KM\HONYWLVA02.VIS  !
RESTARTE.DAT  output   ! RSTARTE=S:\BART\HONYWLVA\12KM\HONYWLVA02.RES  !
--------------------------------------------------------------------------------
Emission Files
--------------
PTEMARB.DAT   input    * PTDAT  =              *
VOLEMARB.DAT  input    * VOLDAT =              *
BAEMARB.DAT   input    * ARDAT  =              *
LNEMARB.DAT   input    * LNDAT  =              *
--------------------------------------------------------------------------------
Other Files
-----------
OZONE.DAT     input    ! OZDAT  =S:\BART\HONYWLVA\OZONE\OZONEX02.DAT    !
VD.DAT        input    * VDDAT  =              *
CHEM.DAT      input    * CHEMDAT=              *
H2O2.DAT      input    * H2O2DAT=              *
HILL.DAT      input    * HILDAT=               *
HILLRCT.DAT   input    * RCTDAT=               *
COASTLN.DAT   input    * CSTDAT=               *
FLUXBDY.DAT   input    * BDYDAT=               *
```

```
BCON.DAT      input    * BCNDAT=               *
DEBUG.DAT     output   * DEBUG =               *
MASSFLX.DAT   output   * FLXDAT=               *
MASSBAL.DAT   output   * BALDAT=               *
FOG.DAT       output   * FOGDAT=               *
------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 70 characters in length


Provision for multiple input files
----------------------------------

     Number of CALMET.DAT files for run (NMETDAT)
                                    Default: 1       ! NMETDAT =   12   !

     Number of PTEMARB.DAT files for run (NPTDAT)
                                    Default: 0       ! NPTDAT =  0  !

     Number of BAEMARB.DAT files for run (NARDAT)
                                    Default: 0       ! NARDAT =  0  !

     Number of VOLEMARB.DAT files for run (NVOLDAT)
                                    Default: 0       ! NVOLDAT =  0  !

!END!

-------------
Subgroup (0a)
-------------

  The following CALMET.DAT filenames are processed in sequence if NMETDAT>1

Default Name  Type          File Name
------------  ----          ---------
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-01R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-02R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-03R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-04R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-05R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-06R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-07R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-08R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-09R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-10R.DAT     !  !END!
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-11R.DAT     !  !END!
```

```
 none         input    ! METDAT=K:\DOMAIN0-2002\MET2002-12R.DAT     !  !END!


--------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

    Option to run all periods found
    in the met. file     (METRUN)   Default: 0       ! METRUN =   0  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in met. file

     Starting date:   Year (IBYR) -- No default       ! IBYR =  2002 !
     (used only if   Month (IBMO) -- No default       ! IBMO =  1    !
      METRUN = 0)      Day (IBDY) -- No default       ! IBDY =  1    !
                      Hour (IBHR) -- No default       ! IBHR =  1    !

     Base time zone        (XBTZ) -- No default       ! XBTZ = 5.0   !
        PST = 8., MST = 7.
        CST = 6., EST = 5.

     Length of run (hours) (IRLG) -- No default       ! IRLG =  8760 !

     Number of chemical species (NSPEC)
                                  Default: 5       ! NSPEC =  20  !

     Number of chemical species
     to be emitted  (NSE)         Default: 3       ! NSE =  19  !

     Flag to stop run after
     SETUP phase (ITEST)          Default: 2       ! ITEST =  2   !
     (Used to allow checking
     of the model inputs, files, etc.)
           ITEST = 1 - STOPS program after SETUP phase
           ITEST = 2 - Continues with execution of program
                       after SETUP

     Restart Configuration:

        Control flag (MRESTART)      Default: 0       ! MRESTART =  0   !

           0 = Do not read or write a restart file
           1 = Read a restart file at the beginning of
               the run
           2 = Write a restart file during run
           3 = Read a restart file at beginning of run
               and write a restart file during run
```

```
        Number of periods in Restart
        output cycle (NRESPD)        Default: 0       ! NRESPD =  0   !

           0 = File written only at last period
          >0 = File updated every NRESPD periods

     Meteorological Data Format (METFM)
                                     Default: 1       ! METFM =  1   !

           METFM = 1 - CALMET binary file (CALMET.MET)
           METFM = 2 - ISC ASCII file (ISCMET.MET)
           METFM = 3 - AUSPLUME ASCII file (PLMMET.MET)
           METFM = 4 - CTDM plus tower file (PROFILE.DAT) and
                       surface parameters file (SURFACE.DAT)
           METFM = 5 - AERMET tower file (PROFILE.DAT) and
                       surface parameters file (SURFACE.DAT)

     Meteorological Profile Data Format (MPRFFM)
            (used only for METFM = 1, 2, 3)
                                     Default: 1       ! MPRFFM =  1   !

           MPRFFM = 1 - CTDM plus tower file (PROFILE.DAT)
           MPRFFM = 2 - AERMET tower file (PROFILE.DAT)

     PG sigma-y is adjusted by the factor (AVET/PGTIME)**0.2
     Averaging Time (minutes) (AVET)
                                     Default: 60.0    ! AVET = 60. !
     PG Averaging Time (minutes) (PGTIME)
                                     Default: 60.0    ! PGTIME = 60. !


!END!


------------------------------------------------------------------------------

INPUT GROUP: 2 -- Technical options
--------------


     Vertical distribution used in the
     near field (MGAUSS)                  Default: 1     ! MGAUSS =  1   !
        0 = uniform
        1 = Gaussian

     Terrain adjustment method
     (MCTADJ)                             Default: 3     ! MCTADJ =  3   !
        0 = no adjustment
```

```
        1 = ISC-type of terrain adjustment
        2 = simple, CALPUFF-type of terrain
            adjustment
        3 = partial plume path adjustment

     Subgrid-scale complex terrain
     flag (MCTSG)                          Default: 0     ! MCTSG =  0   !
        0 = not modeled
        1 = modeled

     Near-field puffs modeled as
     elongated slugs? (MSLUG)              Default: 0     ! MSLUG =  0   !
        0 = no
        1 = yes (slug model used)

     Transitional plume rise modeled?
     (MTRANS)                              Default: 1     ! MTRANS =  1   !
        0 = no  (i.e., final rise only)
        1 = yes (i.e., transitional rise computed)

     Stack tip downwash? (MTIP)            Default: 1     ! MTIP =  1  !
        0 = no  (i.e., no stack tip downwash)
        1 = yes (i.e., use stack tip downwash)

     Method used to simulate building
     downwash? (MBDW)                      Default: 1     ! MBDW =   1  !
        1 = ISC method
        2 = PRIME method

     Vertical wind shear modeled above
     stack top? (MSHEAR)                   Default: 0     ! MSHEAR =  0  !
        0 = no  (i.e., vertical wind shear not modeled)
        1 = yes (i.e., vertical wind shear modeled)

     Puff splitting allowed? (MSPLIT)      Default: 0     ! MSPLIT =  0  !
        0 = no (i.e., puffs not split)
        1 = yes (i.e., puffs are split)

     Chemical mechanism flag (MCHEM)       Default: 1     ! MCHEM =  1   !
        0 = chemical transformation not
            modeled
        1 = transformation rates computed
            internally (MESOPUFF II scheme)
        2 = user-specified transformation
            rates used
        3 = transformation rates computed
            internally (RIVAD/ARM3 scheme)
        4 = secondary organic aerosol formation
            computed (MESOPUFF II scheme for OH)
```

```
Aqueous phase transformation flag (MAQCHEM)
(Used only if MCHEM = 1, or 3)        Default: 0     ! MAQCHEM =  0   !
   0 = aqueous phase transformation
       not modeled
   1 = transformation rates adjusted
       for aqueous phase reactions

Wet removal modeled ? (MWET)          Default: 1     ! MWET =  1   !
   0 = no
   1 = yes

Dry deposition modeled ? (MDRY)       Default: 1     ! MDRY =  1   !
   0 = no
   1 = yes
   (dry deposition method specified
    for each species in Input Group 3)


Gravitational settling (plume tilt)
modeled ? (MTILT)                     Default: 0     ! MTILT =  0   !
   0 = no
   1 = yes
   (puff center falls at the gravitational
    settling velocity for 1 particle species)

Restrictions:
    - MDRY  = 1
    - NSPEC = 1  (must be particle species as well)
    - sg    = 0  GEOMETRIC STANDARD DEVIATION in Group 8 is
                 set to zero for a single particle diameter

Method used to compute dispersion
coefficients (MDISP)                  Default: 3     ! MDISP =  3   !

   1 = dispersion coefficients computed from measured values
       of turbulence, sigma v, sigma w
   2 = dispersion coefficients from internally calculated
       sigma v, sigma w using micrometeorological variables
       (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
       the ISCST multi-segment approximation) and MP coefficients in
       urban areas
   4 = same as 3 except PG coefficients computed using
       the MESOPUFF II eqns.
   5 = CTDM sigmas used for stable and neutral conditions.
       For unstable conditions, sigmas are computed as in
       MDISP = 3, described above.  MDISP = 5 assumes that
       measured values are read
```

```
Sigma-v/sigma-theta, sigma-w measurements used? (MTURBVW)
(Used only if MDISP = 1 or 5)         Default: 3     ! MTURBVW =  3  !
   1 = use sigma-v or sigma-theta measurements
       from PROFILE.DAT to compute sigma-y
       (valid for METFM = 1, 2, 3, 4, 5)
   2 = use sigma-w measurements
       from PROFILE.DAT to compute sigma-z
       (valid for METFM = 1, 2, 3, 4, 5)
   3 = use both sigma-(v/theta) and sigma-w
       from PROFILE.DAT to compute sigma-y and sigma-z
       (valid for METFM = 1, 2, 3, 4, 5)
   4 = use sigma-theta measurements
       from PLMMET.DAT to compute sigma-y
       (valid only if METFM = 3)

Back-up method used to compute dispersion
when measured turbulence data are
missing (MDISP2)                      Default: 3     ! MDISP2 =  3  !
(used only if MDISP = 1 or 5)
   2 = dispersion coefficients from internally calculated
       sigma v, sigma w using micrometeorological variables
       (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
       the ISCST multi-segment approximation) and MP coefficients in
       urban areas
   4 = same as 3 except PG coefficients computed using
       the MESOPUFF II eqns.

[DIAGNOSTIC FEATURE]
Method used for Lagrangian timescale for Sigma-y
(used only if MDISP=1,2 or MDISP2=1,2)
(MTAULY)                              Default: 0     ! MTAULY =  0  !
   0 = Draxler default 617.284 (s)
   1 = Computed as Lag. Length / (.75 q) -- after SCIPUFF
  10 < Direct user input (s)             -- e.g., 306.9


[DIAGNOSTIC FEATURE]
Method used for Advective-Decay timescale for Turbulence
(used only if MDISP=2 or MDISP2=2)
(MTAUADV)                             Default: 0     ! MTAUADV =  0  !
   0 = No turbulence advection
   1 = Computed (OPTION NOT IMPLEMENTED)
  10 < Direct user input (s)   -- e.g., 300


Method used to compute turbulence sigma-v &
sigma-w using micrometeorological variables
```

```
(Used only if MDISP = 2 or MDISP2 = 2)
(MCTURB)                              Default: 1     ! MCTURB =  1  !
   1 = Standard CALPUFF subroutines
   2 = AERMOD subroutines

PG sigma-y,z adj. for roughness?      Default: 0     ! MROUGH =  0  !
(MROUGH)
   0 = no
   1 = yes

Partial plume penetration of          Default: 1     ! MPARTL =  1  !
elevated inversion?
(MPARTL)
   0 = no
   1 = yes

Strength of temperature inversion     Default: 0     ! MTINV =  0  !
provided in PROFILE.DAT extended records?
(MTINV)
   0 = no (computed from measured/default gradients)
   1 = yes

PDF used for dispersion under convective conditions?
                                      Default: 0     ! MPDF =  0  !
(MPDF)
   0 = no
   1 = yes

Sub-Grid TIBL module used for shore line?
                                      Default: 0     ! MSGTIBL = 0  !
(MSGTIBL)
   0 = no
   1 = yes

Boundary conditions (concentration) modeled?
                                      Default: 0     ! MBCON = 0  !
(MBCON)
   0 = no
   1 = yes, using formatted BCON.DAT file
   2 = yes, using unformatted CONC.DAT file


Analyses of fogging and icing impacts due to emissions from
arrays of mechanically-forced cooling towers can be performed
using CALPUFF in conjunction with a cooling tower emissions
processor (CTEMISS) and its associated postprocessors.  Hourly
emissions of water vapor and temperature from each cooling tower
cell are computed for the current cell configuration and ambient
conditions by CTEMISS. CALPUFF models the dispersion of these
```

```
     emissions and provides cloud information in a specialized format
     for further analysis. Output to FOG.DAT is provided in either
     'plume mode' or 'receptor mode' format.

     Configure for FOG Model output?
                                          Default: 0     ! MFOG =  0   !
     (MFOG)
        0 = no
        1 = yes  - report results in PLUME Mode format
        2 = yes  - report results in RECEPTOR Mode format


     Test options specified to see if
     they conform to regulatory
     values? (MREG)                       Default: 1     ! MREG =  1   !

        0 = NO checks are made
        1 = Technical options must conform to USEPA
            Long Range Transport (LRT) guidance
                       METFM    1 or 2
                       AVET     60. (min)
                       PGTIME   60. (min)
                       MGAUSS   1
                       MCTADJ   3
                       MTRANS   1
                       MTIP     1
                       MCHEM    1 or 3 (if modeling SOx, NOx)
                       MWET     1
                       MDRY     1
                       MDISP    2 or 3
                       MPDF     0 if MDISP=3
                                1 if MDISP=2
                       MROUGH   0
                       MPARTL   1
                       SYTDEP   550. (m)
                       MHFTSZ   0


!END!


------------------------------------------------------------------------------

INPUT GROUP: 3a, 3b -- Species list
-------------------

------------
Subgroup (3a)
------------
```

The following species are modeled:

```
! CSPEC =          SO2 !         !END!
! CSPEC =          SO4 !         !END!
! CSPEC =          NOX !         !END!
! CSPEC =         HNO3 !         !END!
! CSPEC =          NO3 !         !END!
! CSPEC =       POC081 !         !END!
! CSPEC =       POC056 !         !END!
! CSPEC =       PIC081 !         !END!
! CSPEC =       PIC056 !         !END!
! CSPEC =       PMC800 !         !END!
! CSPEC =       PMC425 !         !END!
! CSPEC =       PMF187 !         !END!
! CSPEC =       PMF112 !         !END!
! CSPEC =       PMF081 !         !END!
! CSPEC =       PMF056 !         !END!
! CSPEC =        EC187 !         !END!
! CSPEC =        EC112 !         !END!
! CSPEC =        EC081 !         !END!
! CSPEC =        EC056 !         !END!
! CSPEC =          NH3 !         !END!
```

SPECIES NAME (Limit: 12 Characters in length)	MODELED (0=NO, 1=YES)	EMITTED (0=NO, 1=YES)	Dry DEPOSITED (0=NO, 1=COMPUTED-GAS 2=COMPUTED-PARTICLE 3=USER-SPECIFIED)	OUTPUT GROUP NUMBER (0=NONE, 1=1st CGRUP, 2=2nd CGRUP, 3= etc.)
SO2	1	1	1	0
SO4	1	1	2	0
NOX	1	1	1	0
HNO3	1	0	1	0
NO3	1	1	2	0
POC081	1	1	2	0
POC056	1	1	2	0
PIC081	1	1	2	0
PIC056	1	1	2	0
PMC800	1	1	2	0
PMC425	1	1	2	0
PMF187	1	1	2	0
PMF112	1	1	2	0
PMF081	1	1	2	0
PMF056	1	1	2	0
EC187	1	1	2	0
EC112	1	1	2	0
EC081	1	1	2	0

```
!        EC056  =         1,              1,           2,                0   !
!          NH3  =         1,              1,           1,                0   !

!END!

-------------
Subgroup (3b)
-------------
  The following names are used for Species-Groups in which results
  for certain species are combined (added) prior to output.  The
  CGRUP name will be used as the species name in output files.
  Use this feature to model specific particle-size distributions
  by treating each size-range as a separate species.
  Order must be consistent with 3(a) above.



--------------------------------------------------------------------------------


INPUT GROUP: 4 -- Map Projection and Grid control parameters
--------------

     Projection for all (X,Y):
     -------------------------

     Map projection
     (PMAP)                     Default: UTM    ! PMAP = LCC  !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
          PS :  Polar Stereographic
          EM :  Equatorial Mercator
        LAZA :  Lambert Azimuthal Equal Area

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                    Default=0.0     ! FEAST  = 0.000  !
     (FNORTH)                   Default=0.0     ! FNORTH = 0.000  !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                   No Default      ! IUTMZN =  0   !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)                   Default: N      ! UTMHEM = N  !
         N   :  Northern hemisphere projection
```

```
        S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
     (RLAT0)                    No Default      ! RLAT0 = 40N  !
     (RLON0)                    No Default      ! RLON0 = 97W  !

         TTM :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         LCC :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         PS  :  RLON0 identifies central (grid N/S) meridian of projection
                RLAT0 selected for convenience
         EM  :  RLON0 identifies central meridian of projection
                RLAT0 is REPLACED by 0.0N (Equator)
         LAZA:  RLON0 identifies longitude of tangent-point of mapping plane
                RLAT0 identifies latitude of tangent-point of mapping plane

     Matching parallel(s) of latitude (decimal degrees) for projection
     (Used only if PMAP= LCC or PS)
     (XLAT1)                    No Default      ! XLAT1 = 33N  !
     (XLAT2)                    No Default      ! XLAT2 = 45N  !

         LCC :  Projection cone slices through Earth's surface at XLAT1 and XLAT2
         PS  :  Projection plane slices through Earth at XLAT1
                (XLAT2 is not used)

     ----------
     Note:  Latitudes and longitudes should be positive, and include a
            letter N,S,E, or W indicating north or south latitude, and
            east or west longitude.  For example,
            35.9  N Latitude  =  35.9N
            118.7 E Longitude = 118.7E


     Datum-region
     ------------

     The Datum-Region for the coordinates is identified by a character
     string.  Many mapping products currently available use the model of the
     Earth known as the World Geodetic System 1984 (WGS-84).  Other local
     models may be in use, and their selection in CALMET will make its output
     consistent with local mapping products.  The list of Datum-Regions with
     official transformation parameters is provided by the National Imagery and
     Mapping Agency (NIMA).

     NIMA Datum - Regions(Examples)
     ------------------------------------------------------------------------
     WGS-84    WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)
```

```
     NAS-C     NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)
     NAR-C     NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)
     NWS-84    NWS 6370KM Radius, Sphere
     ESR-S     ESRI REFERENCE 6371KM Radius, Sphere

     Datum-region for output coordinates
     (DATUM)                    Default: WGS-84    ! DATUM = NWS-84  !


METEOROLOGICAL Grid:

     Rectangular grid defined for projection PMAP,
     with X the Easting and Y the Northing coordinate

           No. X grid cells (NX)      No default     ! NX =  160   !
           No. Y grid cells (NY)      No default     ! NY =  172   !
       No. vertical layers (NZ)       No default     ! NZ =  10    !

         Grid spacing (DGRIDKM)       No default     ! DGRIDKM = 12. !
                                      Units: km

              Cell face heights
                  (ZFACE(nz+1))       No defaults
                                      Units: m
  ! ZFACE = 0., 20., 40., 80., 160., 320., 640., 1200., 2000., 3000., 4000. !

           Reference Coordinates
          of SOUTHWEST corner of
               grid cell(1, 1):

           X coordinate (XORIGKM)     No default     ! XORIGKM =   137.973  !
           Y coordinate (YORIGKM)     No default     ! YORIGKM = -1625.974  !
                                     Units: km


COMPUTATIONAL Grid:

     The computational grid is identical to or a subset of the MET. grid.
     The lower left (LL) corner of the computational grid is at grid point
     (IBCOMP, JBCOMP) of the MET. grid.  The upper right (UR) corner of the
     computational grid is at grid point (IECOMP, JECOMP) of the MET. grid.
     The grid spacing of the computational grid is the same as the MET. grid.

        X index of LL corner (IBCOMP)      No default     ! IBCOMP =  105  !
                  (1 <= IBCOMP <= NX)

        Y index of LL corner (JBCOMP)      No default     ! JBCOMP =  102  !
                  (1 <= JBCOMP <= NY)
```

```
        X index of UR corner (IECOMP)      No default     ! IECOMP =  151  !
                  (1 <= IECOMP <= NX)

        Y index of UR corner (JECOMP)      No default     ! JECOMP =  145  !
                  (1 <= JECOMP <= NY)


SAMPLING Grid (GRIDDED RECEPTORS):

     The lower left (LL) corner of the sampling grid is at grid point
     (IBSAMP, JBSAMP) of the MET. grid.  The upper right (UR) corner of the
     sampling grid is at grid point (IESAMP, JESAMP) of the MET. grid.
     The sampling grid must be identical to or a subset of the computational
     grid.  It may be a nested grid inside the computational grid.
     The grid spacing of the sampling grid is DGRIDKM/MESHDN.

        Logical flag indicating if gridded
        receptors are used (LSAMP)         Default: T     ! LSAMP = F !
        (T=yes, F=no)

        X index of LL corner (IBSAMP)      No default     ! IBSAMP =  1   !
         (IBCOMP <= IBSAMP <= IECOMP)

        Y index of LL corner (JBSAMP)      No default     ! JBSAMP =  1   !
         (JBCOMP <= JBSAMP <= JECOMP)


        X index of UR corner (IESAMP)      No default     ! IESAMP =  1   !
         (IBCOMP <= IESAMP <= IECOMP)

        Y index of UR corner (JESAMP)      No default     ! JESAMP =  1   !
         (JBCOMP <= JESAMP <= JECOMP)


       Nesting factor of the sampling
        grid (MESHDN)                      Default: 1     ! MESHDN =  1  !
        (MESHDN is an integer >= 1)

!END!


------------------------------------------------------------------------------


INPUT GROUP: 5 -- Output Options
--------------
                                          *                          *
```

```
     FILE                          DEFAULT VALUE             VALUE THIS RUN
     ----                          -------------             --------------

   Concentrations (ICON)               1                    !  ICON =  1   !
   Dry Fluxes (IDRY)                   1                    !  IDRY =  1   !
   Wet Fluxes (IWET)                   1                    !  IWET =  1   !
   Relative Humidity (IVIS)            1                    !  IVIS =  1   !
    (relative humidity file is
     required for visibility
     analysis)
   Use data compression option in output file?
   (LCOMPRS)                          Default: T            ! LCOMPRS = T !

   *
    0 = Do not create file, 1 = create file


    DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

       Mass flux across specified boundaries
       for selected species reported hourly?
       (IMFLX)                        Default: 0            ! IMFLX =  0  !
         0 = no
         1 = yes (FLUXBDY.DAT and MASSFLX.DAT filenames
                  are specified in Input Group 0)

       Mass balance for each species
       reported hourly?
       (IMBAL)                        Default: 0            ! IMBAL =  0  !
         0 = no
         1 = yes (MASSBAL.DAT filename is
              specified in Input Group 0)


    LINE PRINTER OUTPUT OPTIONS:

       Print concentrations (ICPRT)   Default: 0            ! ICPRT =  0   !
       Print dry fluxes (IDPRT)       Default: 0            ! IDPRT =  0   !
       Print wet fluxes (IWPRT)       Default: 0            ! IWPRT =  0   !
       (0 = Do not print, 1 = Print)

       Concentration print interval
       (ICFRQ) in hours               Default: 1            ! ICFRQ =  1   !
       Dry flux print interval
       (IDFRQ) in hours               Default: 1            ! IDFRQ =  1   !
       Wet flux print interval
       (IWFRQ) in hours               Default: 1            ! IWFRQ =  1   !

       Units for Line Printer Output
```

```
       (IPRTU)                          Default: 1         ! IPRTU =  3   !
                        for              for
                   Concentration    Deposition
              1 =       g/m**3          g/m**2/s
              2 =      mg/m**3         mg/m**2/s
              3 =      ug/m**3         ug/m**2/s
              4 =      ng/m**3         ng/m**2/s
              5 =     Odour Units

       Messages tracking progress of run
       written to the screen ?
       (IMESG)                          Default: 2         ! IMESG =  2   !
         0 = no
         1 = yes (advection step, puff ID)
         2 = yes (YYYYJJJHH, # old puffs, # emitted puffs)


     SPECIES (or GROUP for combined species) LIST FOR OUTPUT OPTIONS

                   ---- CONCENTRATIONS ----   ------ DRY FLUXES ------   ------ WET FLUXES ------   -- MASS
                   FLUX --
    SPECIES
    /GROUP         PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   SAVED ON
    DISK?
    -------        ------------------------   ------------------------   ------------------------
    ---------------
!          SO2 =     0,           1,           0,           1,           0,           1,           0   !
!          SO4 =     0,           1,           0,           1,           0,           1,           0   !
!          NOX =     0,           1,           0,           1,           0,           1,           0   !
!         HNO3 =     0,           1,           0,           1,           0,           1,           0   !
!          NO3 =     0,           1,           0,           1,           0,           1,           0   !
!       POC081 =     0,           1,           0,           0,           0,           0,           0   !
!       POC056 =     0,           1,           0,           0,           0,           0,           0   !
!       PIC081 =     0,           1,           0,           0,           0,           0,           0   !
!       PIC056 =     0,           1,           0,           0,           0,           0,           0   !
!       PMC800 =     0,           1,           0,           0,           0,           0,           0   !
!       PMC425 =     0,           1,           0,           0,           0,           0,           0   !
!       PMF187 =     0,           1,           0,           0,           0,           0,           0   !
!       PMF112 =     0,           1,           0,           0,           0,           0,           0   !
!       PMF081 =     0,           1,           0,           0,           0,           0,           0   !
!       PMF056 =     0,           1,           0,           0,           0,           0,           0   !
!        EC187 =     0,           1,           0,           0,           0,           0,           0   !
!        EC112 =     0,           1,           0,           0,           0,           0,           0   !
!        EC081 =     0,           1,           0,           0,           0,           0,           0   !
!        EC056 =     0,           1,           0,           0,           0,           0,           0   !
!          NH3 =     0,           1,           0,           0,           0,           0,           0   !

     OPTIONS FOR PRINTING "DEBUG" QUANTITIES (much output)
```

```
       Logical for debug output
       (LDEBUG)                                  Default: F     ! LDEBUG = F !

       First puff to track
       (IPFDEB)                                  Default: 1     ! IPFDEB =  1  !

       Number of puffs to track
       (NPFDEB)                                  Default: 1     ! NPFDEB =  10  !

       Met. period to start output
       (NN1)                                     Default: 1     ! NN1 =  10   !

       Met. period to end output
       (NN2)                                     Default: 10    ! NN2 =  10  !

!END!


--------------------------------------------------------------------------------


INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs
-------------------------

---------------
Subgroup (6a)
---------------
       Number of terrain features (NHILL)        Default: 0     ! NHILL =  0   !

       Number of special complex terrain
       receptors  (NCTREC)                       Default: 0     ! NCTREC =  0   !

       Terrain and CTSG Receptor data for
       CTSG hills input in CTDM format ?
       (MHILL)                                   No Default     ! MHILL =  0   !
       1 = Hill and Receptor data created
           by CTDM processors & read from
           HILL.DAT and HILLRCT.DAT files
       2 = Hill data created by OPTHILL &
           input below in Subgroup (6b);
           Receptor data in Subgroup (6c)

       Factor to convert horizontal dimensions   Default: 1.0   ! XHILL2M = 0. !
       to meters (MHILL=1)

       Factor to convert vertical dimensions     Default: 1.0   ! ZHILL2M = 0. !
       to meters (MHILL=1)

       X-origin of CTDM system relative to       No Default     ! XCTDMKM = 0.0E00 !
```

```
       CALPUFF coordinate system, in Kilometers (MHILL=1)

       Y-origin of CTDM system relative to      No Default     ! YCTDMKM = 0.0E00 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

! END !

---------------
Subgroup (6b)
---------------

                      1 **
     HILL information


HILL           XC         YC       THETAH   ZGRID   RELIEF    EXPO 1    EXPO 2   SCALE 1    SCALE 2    AMAX1
AMAX2
 NO.          (km)       (km)      (deg.)    (m)      (m)       (m)       (m)       (m)        (m)       (m)
 (m)
----          ----       ----      ------   -----   ------    ------    ------   -------    -------    -----
-----

---------------
Subgroup (6c)
---------------

    COMPLEX TERRAIN RECEPTOR INFORMATION

                     XRCT         YRCT         ZRCT          XHH
                     (km)         (km)          (m)
                    ------       -----       ------         ----


-------------------
1
     Description of Complex Terrain Variables:
          XC, YC  = Coordinates of center of hill
          THETAH  = Orientation of major axis of hill (clockwise from
                    North)
          ZGRID   = Height of the  0  of the grid above mean sea
                    level
          RELIEF  = Height of the crest of the hill above the grid elevation
          EXPO 1  = Hill-shape exponent for the major axis
          EXPO 2  = Hill-shape exponent for the major axis
          SCALE 1 = Horizontal length scale along the major axis
          SCALE 2 = Horizontal length scale along the minor axis
          AMAX    = Maximum allowed axis length for the major axis
          BMAX    = Maximum allowed axis length for the major axis
```

```
          XRCT, YRCT = Coordinates of the complex terrain receptors
          ZRCT    = Height of the ground (MSL) at the complex terrain
                    Receptor
          XHH     = Hill number associated with each complex terrain receptor
                    (NOTE: MUST BE ENTERED AS A REAL NUMBER)

   **
     NOTE: DATA for each hill and CTSG receptor are treated as a separate
           input subgroup and therefore must end with an input group terminator.

-------------------------------------------------------------------------------


INPUT GROUP: 7 -- Chemical parameters for dry deposition of gases
--------------

      SPECIES     DIFFUSIVITY      ALPHA STAR      REACTIVITY    MESOPHYLL RESISTANCE     HENRY'S LAW
      COEFFICIENT
       NAME         (cm**2/s)                                          (s/cm)
       (dimensionless)
      -------     -----------      ----------      ----------    --------------------
      ------------------------

!          SO2 =     0.1509,         1000.,            8.,               0.,                 0.04 !
!          NOX =     0.1656,            1.,            8.,               5.,                  3.5 !
!         HNO3 =     0.1628,            1.,           18.,               0.,           0.00000008 !
!          NH3 =     0.2340,           0.2,            4.,               0.,             0.000359 !

!END!


-------------------------------------------------------------------------------


INPUT GROUP: 8 -- Size parameters for dry deposition of particles
--------------

     For SINGLE SPECIES, the mean and standard deviation are used to
     compute a deposition velocity for NINT (see group 9) size-ranges,
     and these are then averaged to obtain a mean deposition velocity.

     For GROUPED SPECIES, the size distribution should be explicitly
     specified (by the 'species' in the group), and the standard deviation
     for each should be entered as 0.  The model will then use the
     deposition velocity for the stated mean diameter.

      SPECIES      GEOMETRIC MASS MEAN        GEOMETRIC STANDARD
       NAME             DIAMETER                   DEVIATION
                         (microns)                  (microns)
```

```
      -------      -------------------        ------------------
!          SO4 =          0.48,                      2.   !
!          NO3 =          0.48,                      2.   !
!       POC081 =        0.8125,                      0.   !
!       POC056 =        0.5625,                      0.   !
!       PIC081 =        0.8125,                      0.   !
!       PIC056 =        0.5625,                      0.   !
!       PMC800 =            8.,                      0.   !
!       PMC425 =          4.25,                      0.   !
!       PMF187 =         1.875,                      0.   !
!       PMF112 =         1.125,                      0.   !
!       PMF081 =        0.8125,                      0.   !
!       PMF056 =        0.5625,                      0.   !
!        EC187 =         1.875,                      0.   !
!        EC112 =         1.125,                      0.   !
!        EC081 =        0.8125,                      0.   !
!        EC056 =        0.5625,                      0.   !

!END!


--------------------------------------------------------------------------------


INPUT GROUP: 9 -- Miscellaneous dry deposition parameters
--------------

     Reference cuticle resistance (s/cm)
     (RCUTR)                          Default: 30    !  RCUTR = 30.0 !
     Reference ground resistance  (s/cm)
     (RGR)                            Default: 10    !    RGR = 10.0 !
     Reference pollutant reactivity
     (REACTR)                         Default: 8     ! REACTR = 8.0 !

     Number of particle-size intervals used to
     evaluate effective particle deposition velocity
     (NINT)                           Default: 9     !   NINT =  9  !

     Vegetation state in unirrigated areas
     (IVEG)                           Default: 1     !   IVEG =  1   !
        IVEG=1 for active and unstressed vegetation
        IVEG=2 for active and stressed vegetation
        IVEG=3 for inactive vegetation

!END!


--------------------------------------------------------------------------------
```

INPUT GROUP: 10 -- Wet Deposition Parameters

Scavenging Coefficient -- Units: (sec)**(-1)

Pollutant	Liquid Precip.	Frozen Precip.
SO2 =	3.0E-05,	0.0E00
SO4 =	1.0E-04,	3.0E-05
NOX =	0.0E00,	0.0E00
HNO3 =	6.0E-05,	0.0E00
NO3 =	1.0E-04,	3.0E-05
POC081 =	1.0E-04,	3.0E-05
POC056 =	1.0E-04,	3.0E-05
PIC081 =	1.0E-04,	3.0E-05
PIC056 =	1.0E-04,	3.0E-05
PMC800 =	1.0E-04,	3.0E-05
PMC425 =	1.0E-04,	3.0E-05
PMF187 =	1.0E-04,	3.0E-05
PMF112 =	1.0E-04,	3.0E-05
PMF081 =	1.0E-04,	3.0E-05
PMF056 =	1.0E-04,	3.0E-05
EC187 =	1.0E-04,	3.0E-05
EC112 =	1.0E-04,	3.0E-05
EC081 =	1.0E-04,	3.0E-05
EC056 =	1.0E-04,	3.0E-05
NH3 =	8.0E-05,	0.0E00

!END!

INPUT GROUP: 11 -- Chemistry Parameters

Ozone data input option (MOZ) Default: 1 ! MOZ = 1 !
(Used only if MCHEM = 1, 3, or 4)
0 = use a monthly background ozone value
1 = read hourly ozone concentrations from
the OZONE.DAT data file

Monthly ozone concentrations
(Used only if MCHEM = 1, 3, or 4 and
MOZ = 0 or MOZ = 1 and all hourly O3 data missing)
(BCKO3) in ppb Default: 12*80.

```
 ! BCKO3      =  27.58, 32.93, 37.42, 45.03, 48.62, 54.14, 52.99, 51.58, 41.09, 28.07, 24.53, 24.25 !

     Monthly ammonia concentrations
     (Used only if MCHEM = 1, or 3)
     (BCKNH3) in ppb                   Default: 12*10.
     !  BCKNH3 = 0.50, 0.50, 0.50, 0.50, 0.50, 0.50, 0.50, 0.50, 0.50, 0.50, 0.50, 0.50 !

     Nighttime SO2 loss rate (RNITE1)
     in percent/hour                   Default: 0.2          ! RNITE1 = 0.2 !

     Nighttime NOx loss rate (RNITE2)
     in percent/hour                   Default: 2.0          ! RNITE2 = 2.0 !

     Nighttime HNO3 formation rate (RNITE3)
     in percent/hour                   Default: 2.0          ! RNITE3 = 2.0 !

     H2O2 data input option (MH2O2)    Default: 1            ! MH2O2 =  1   !
     (Used only if MAQCHEM = 1)
        0 = use a monthly background H2O2 value
        1 = read hourly H2O2 concentrations from
            the H2O2.DAT data file

     Monthly H2O2 concentrations
     (Used only if MQACHEM = 1 and
      MH2O2 = 0 or MH2O2 = 1 and all hourly H2O2 data missing)
     (BCKH2O2) in ppb                  Default: 12*1.
     !  BCKH2O2 = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00 !


 --- Data for SECONDARY ORGANIC AEROSOL (SOA) Option
     (used only if MCHEM = 4)

     The SOA module uses monthly values of:
          Fine particulate concentration in ug/m^3 (BCKPMF)
          Organic fraction of fine particulate     (OFRAC)
          VOC / NOX ratio (after reaction)         (VCNX)
     to characterize the air mass when computing
     the formation of SOA from VOC emissions.
     Typical values for several distinct air mass types are:

        Month    1    2    3    4    5    6    7    8    9   10   11   12
                Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec

     Clean Continental
        BCKPMF   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.
        OFRAC  .15  .15  .20  .20  .20  .20  .20  .20  .20  .20  .20  .15
        VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.

     Clean Marine (surface)
```

```
        BCKPMF  .5   .5   .5   .5   .5   .5   .5   .5   .5   .5   .5   .5
        OFRAC  .25  .25  .30  .30  .30  .30  .30  .30  .30  .30  .30  .25
        VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.

     Urban - low biogenic (controls present)
        BCKPMF  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.
        OFRAC  .20  .20  .25  .25  .25  .25  .25  .25  .20  .20  .20  .20
        VCNX     4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.

     Urban - high biogenic (controls present)
        BCKPMF  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.
        OFRAC  .25  .25  .30  .30  .30  .55  .55  .55  .35  .35  .35  .25
        VCNX    15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.

     Regional Plume
        BCKPMF  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.
        OFRAC  .20  .20  .25  .35  .25  .40  .40  .40  .30  .30  .30  .20
        VCNX    15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.

     Urban - no controls present
        BCKPMF 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
        OFRAC  .30  .30  .35  .35  .35  .55  .55  .55  .35  .35  .35  .30
        VCNX     2.   2.   2.   2.   2.   2.   2.   2.   2.   2.   2.   2.

     Default: Clean Continental
     !  BCKPMF = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00 !
     !  OFRAC  = 0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.15 !
     !  VCNX   = 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00 !


!END!


---------------------------------------------------------------------------


INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters
---------------

     Horizontal size of puff (m) beyond which
     time-dependent dispersion equations (Heffter)
     are used to determine sigma-y and
     sigma-z (SYTDEP)                          Default: 550.    ! SYTDEP = 5.5E02 !

     Switch for using Heffter equation for sigma z
     as above (0 = Not use Heffter; 1 = use Heffter
     (MHFTSZ)                                  Default: 0       ! MHFTSZ =  0    !

     Stability class used to determine plume
```

```
     growth rates for puffs above the boundary
     layer (JSUP)                              Default: 5      ! JSUP =  5   !

     Vertical dispersion constant for stable
     conditions (k1 in Eqn. 2.7-3)  (CONK1)    Default: 0.01   ! CONK1 = .01 !

     Vertical dispersion constant for neutral/
     unstable conditions (k2 in Eqn. 2.7-4)
     (CONK2)                                   Default: 0.1    ! CONK2 = .1 !

     Factor for determining Transition-point from
     Schulman-Scire to Huber-Snyder Building Downwash
     scheme (SS used for Hs < Hb + TBD * HL)
     (TBD)                                     Default: 0.5    ! TBD = .5 !
        TBD < 0   ==> always use Huber-Snyder
        TBD = 1.5 ==> always use Schulman-Scire
        TBD = 0.5 ==> ISC Transition-point

     Range of land use categories for which
     urban dispersion is assumed
     (IURB1, IURB2)                            Default: 10     ! IURB1 =  10  !
                                                        19     ! IURB2 =  19  !

     Site characterization parameters for single-point Met data files ---------
     (needed for METFM = 2,3,4,5)

        Land use category for modeling domain
        (ILANDUIN)                             Default: 20     ! ILANDUIN =  20  !

        Roughness length (m) for modeling domain
        (Z0IN)                                 Default: 0.25   ! Z0IN = .25 !

        Leaf area index for modeling domain
        (XLAIIN)                               Default: 3.0    ! XLAIIN = 3.0 !

        Elevation above sea level (m)
        (ELEVIN)                               Default: 0.0    ! ELEVIN = .0 !

        Latitude (degrees) for met location
        (XLATIN)                               Default: -999.  ! XLATIN = -999.0 !

        Longitude (degrees) for met location
        (XLONIN)                               Default: -999.  ! XLONIN = -999.0 !

     Specialized information for interpreting single-point Met data files -----

        Anemometer height (m) (Used only if METFM = 2,3)
        (ANEMHT)                               Default: 10.    ! ANEMHT = 10.0 !
```

```
   Form of lateral turbulance data in PROFILE.DAT file
   (Used only if METFM = 4,5 or MTURBVW = 1 or 3)
   (ISIGMAV)                                Default: 1      ! ISIGMAV =  1  !
       0 = read sigma-theta
       1 = read sigma-v

   Choice of mixing heights (Used only if METFM = 4)
   (IMIXCTDM)                               Default: 0      ! IMIXCTDM =  0  !
       0 = read PREDICTED mixing heights
       1 = read OBSERVED mixing heights

Maximum length of a slug (met. grid units)
(XMXLEN)                                    Default: 1.0    ! XMXLEN = 1.0 !

Maximum travel distance of a puff/slug (in
grid units) during one sampling step
(XSAMLEN)                                   Default: 1.0    ! XSAMLEN = 1.0 !

Maximum Number of slugs/puffs release from
one source during one time step
(MXNEW)                                     Default: 99     ! MXNEW =  99   !

Maximum Number of sampling steps for
one puff/slug during one time step
(MXSAM)                                     Default: 99     ! MXSAM =  99   !

Number of iterations used when computing
the transport wind for a sampling step
that includes gradual rise (for CALMET
and PROFILE winds)
(NCOUNT)                                    Default: 2      ! NCOUNT =  2   !

Minimum sigma y for a new puff/slug (m)
(SYMIN)                                     Default: 1.0    ! SYMIN = 1.0  !

Minimum sigma z for a new puff/slug (m)
(SZMIN)                                     Default: 1.0    ! SZMIN = 1.0  !

Default minimum turbulence velocities sigma-v and sigma-w
for each stability class over land and over water (m/s)
(SVMIN(12) and SWMIN(12))

                ----------  LAND  ----------       ---------  WATER  ----------
   Stab Class :  A    B    C    D    E    F         A    B    C    D    E    F
                ---  ---  ---  ---  ---  ---       ---  ---  ---  ---  ---  ---
Default SVMIN : .50, .50, .50, .50, .50, .50,      .37, .37, .37, .37, .37, .37
Default SWMIN : .20, .12, .08, .06, .03, .016,     .20, .12, .08, .06, .03, .016

      ! SVMIN = 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.370, 0.370, 0.370, 0.370, 0.370, 0.370!
```

```
      ! SWMIN = 0.200, 0.120, 0.080, 0.060, 0.030, 0.016, 0.200, 0.120, 0.080, 0.060, 0.030, 0.016!

   Divergence criterion for dw/dz across puff
   used to initiate adjustment for horizontal
   convergence (1/s)
   Partial adjustment starts at CDIV(1), and
   full adjustment is reached at CDIV(2)
   (CDIV(2))                                  Default: 0.0,0.0  ! CDIV = .0, .0 !

   Minimum wind speed (m/s) allowed for
   non-calm conditions. Also used as minimum
   speed returned when using power-law
   extrapolation toward surface
   (WSCALM)                                   Default: 0.5    ! WSCALM = .5 !

   Maximum mixing height (m)
   (XMAXZI)                                   Default: 3000.  ! XMAXZI = 3000.0 !

   Minimum mixing height (m)
   (XMINZI)                                   Default: 50.    ! XMINZI = 50.0 !

   Default wind speed classes --
   5 upper bounds (m/s) are entered;
   the 6th class has no upper limit
   (WSCAT(5))                        Default   :
                                     ISC RURAL : 1.54, 3.09, 5.14, 8.23, 10.8 (10.8+)

                                Wind Speed Class :  1     2     3     4     5
                                                   ---   ---   ---   ---   ---
                                       ! WSCAT = 1.54, 3.09, 5.14, 8.23, 10.80 !

   Default wind speed profile power-law
   exponents for stabilities 1-6
   (PLX0(6))                         Default   : ISC RURAL values
                                     ISC RURAL : .07, .07, .10, .15, .35, .55
                                     ISC URBAN : .15, .15, .20, .25, .30, .30

                                 Stability Class :  A     B     C     D     E     F
                                                   ---   ---   ---   ---   ---   ---
                                       ! PLX0 = 0.07, 0.07, 0.10, 0.15, 0.35, 0.55 !

   Default potential temperature gradient
   for stable classes E, F (degK/m)
   (PTG0(2))                         Default: 0.020, 0.035
                                        ! PTG0 = 0.020,   0.035 !

   Default plume path coefficients for
   each stability class (used when option
   for partial plume height terrain adjustment
```

```
     is selected -- MCTADJ=3)
     (PPC(6))                  Stability Class :  A     B     C     D     E     F
                                  Default  PPC : .50,  .50,  .50,  .50,  .35,  .35
                                                 ---   ---   ---   ---   ---   ---
                                       !  PPC = 0.50, 0.50, 0.50, 0.50, 0.35, 0.35 !

     Slug-to-puff transition criterion factor
     equal to sigma-y/length of slug
     (SL2PF)                              Default: 10.        ! SL2PF = 5.0 !

     Puff-splitting control variables ------------------------

       VERTICAL SPLIT
       --------------

       Number of puffs that result every time a puff
       is split - nsplit=2 means that 1 puff splits
       into 2
       (NSPLIT)                           Default:   3        ! NSPLIT =  3  !

       Time(s) of a day when split puffs are eligible to
       be split once again; this is typically set once
       per day, around sunset before nocturnal shear develops.
       24 values: 0 is midnight (00:00) and 23 is 11 PM (23:00)
       0=do not re-split    1=eligible for re-split
       (IRESPLIT(24))                     Default:  Hour 17 = 1
       !  IRESPLIT = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0 !

       Split is allowed only if last hour's mixing
       height (m) exceeds a minimum value
       (ZISPLIT)                          Default: 100.       ! ZISPLIT = 100.0 !

       Split is allowed only if ratio of last hour's
       mixing ht to the maximum mixing ht experienced
       by the puff is less than a maximum value (this
       postpones a split until a nocturnal layer develops)
       (ROLDMAX)                          Default: 0.25       ! ROLDMAX = 0.25 !


       HORIZONTAL SPLIT
       ----------------

       Number of puffs that result every time a puff
       is split - nsplith=5 means that 1 puff splits
       into 5
       (NSPLITH)                          Default:   5        ! NSPLITH =  5  !

       Minimum sigma-y (Grid Cells Units) of puff
       before it may be split
```

```
       (SYSPLITH)                          Default:  1.0       ! SYSPLITH = 1.0 !

       Minimum puff elongation rate (SYSPLITH/hr) due to
       wind shear, before it may be split
       (SHSPLITH)                          Default:  2.        ! SHSPLITH = 2.0 !

       Minimum concentration (g/m^3) of each
       species in puff before it may be split
       Enter array of NSPEC values; if a single value is
       entered, it will be used for ALL species
       (CNSPLITH)                          Default:  1.0E-07   ! CNSPLITH = 1.0E-07 !

     Integration control variables ------------------------

       Fractional convergence criterion for numerical SLUG
       sampling integration
       (EPSSLUG)                           Default:   1.0e-04  ! EPSSLUG = 1.0E-04 !

       Fractional convergence criterion for numerical AREA
       source integration
       (EPSAREA)                           Default:   1.0e-06  ! EPSAREA = 1.0E-06 !

       Trajectory step-length (m) used for numerical rise
       integration
       (DSRISE)                            Default:   1.0      ! DSRISE = 1.0 !

       Boundary Condition (BC) Puff control variables -------------------------

       Minimum height (m) to which BC puffs are mixed as they are emitted
       (MBCON=2 ONLY).  Actual height is reset to the current mixing height
       at the release point if greater than this minimum.
       (HTMINBC)                           Default:   500.     ! HTMINBC = 500.0 !

       Search radius (km) about a receptor for sampling nearest BC puff.
       BC puffs are typically emitted with a spacing of one grid cell
       length, so the search radius should be greater than DGRIDKM.
       (RSAMPBC)                           Default:   10.      ! RSAMPBC = 15.0 !

       Near-Surface depletion adjustment to concentration profile used when
       sampling BC puffs?
       (MDEPBC)                            Default:   1        ! MDEPBC =  0  !
          0 = Concentration is NOT adjusted for depletion
          1 = Adjust Concentration for depletion

!END!


-------------------------------------------------------------------------------
```

INPUT GROUPS: 13a, 13b, 13c, 13d -- Point source parameters

Subgroup (13a)

Number of point sources with parameters provided below (NPT1) No default ! NPT1 = 10 !

Units used for point source emissions below (IPTU) Default: 1 ! IPTU = 1 !

1 = g/s
2 = kg/hr
3 = lb/hr
4 = tons/yr
5 = Odour Unit * m**3/s (vol. flux of odour compound)
6 = Odour Unit * m**3/min
7 = metric tons/yr

Number of source-species combinations with variable emissions scaling factors provided below in (13d) (NSPT1) Default: 0 ! NSPT1 = 0 !

Number of point sources with variable emission parameters provided in external file (NPT2) No default ! NPT2 = 0 !

(If NPT2 > 0, these point source emissions are read from the file: PTEMARB.DAT)

!END!

Subgroup (13b)

POINT SOURCE: CONSTANT DATA [a]

Source No.	X Coordinate (km)	Y Coordinate (km)	Stack Height (m)	Base Elevation (m)	Stack Diameter (m)	Exit Vel. (m/s)	Exit Temp. (deg. K)	Bldg. Dwash [b]	Emission Rates [c]
1 ! SRCNAM = 103 !									
1 ! X = 1722.333,	-110.650,	32.00,	12.2,	3.44,	13.68,	387.6,	.0,		

```
      1.47E-01, 0.00E+00, 1.74E+01, 0.00E+00, 0.00E+00,
      4.24E-01, 4.24E-01, 4.80E-02, 4.80E-02,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 4.41E-02, 2.50E-01,
      0.00E+00, 0.00E+00, 3.17E-03, 1.79E-02, 2.80E-01 !
   1 ! ZPLTFM  =       .0 !
   1 ! FMFAC  =      1.0 !   !END!

   2 ! SRCNAM = 106 !
   2 ! X = 1722.333, -110.650,   15.24,  12.2,     1.52,   6.60,  433.2,  .0,
      1.05E-02, 0.00E+00, 2.16E+00, 0.00E+00, 0.00E+00,
      3.91E-02, 3.91E-02, 4.42E-03, 4.42E-03,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 4.06E-03, 2.30E-02,
      0.00E+00, 0.00E+00, 2.91E-04, 1.65E-03, 3.64E-02 !
   2 ! ZPLTFM  =       .0 !
   2 ! FMFAC  =      1.0 !   !END!

   3 ! SRCNAM = 405 !
   3 ! X = 1722.333, -110.650,   45.72,  12.2,     0.76,  12.42,  358.2,  .0,
      1.26E+00, 1.93E-02, 3.15E+00, 0.00E+00, 0.00E+00,
      1.05E-02, 1.05E-02, 9.78E-03, 9.78E-03,
      5.52E-03, 6.44E-03, 3.41E-03, 8.52E-04, 1.70E-03, 2.98E-02,
      2.72E-04, 6.81E-05, 1.36E-04, 2.38E-03, 0.00E+00 !
   3 ! ZPLTFM  =       .0 !
   3 ! FMFAC  =      1.0 !   !END!

   4 ! SRCNAM = 902 !
   4 ! X = 1722.333, -110.650,   38.10,  12.2,     0.41,  34.77,  278.2,  .0,
      0.00E+00, 0.00E+00, 7.01E+01, 0.00E+00, 8.30E-01,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 3.84E+01 !
   4 ! ZPLTFM  =       .0 !
   4 ! FMFAC  =      1.0 !   !END!

   5 ! SRCNAM = 907 !
   5 ! X = 1722.333, -110.650,   40.23,  12.2,     0.61,  18.27,  288.2,  .0,
      2.10E-02, 0.00E+00, 3.29E+01, 0.00E+00, 0.00E+00,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
      0.00E+00, 0.00E+00, 2.04E-02, 1.16E-01, 2.75E+01 !
   5 ! ZPLTFM  =       .0 !
   5 ! FMFAC  =      1.0 !   !END!

   6 ! SRCNAM = 903 !
   6 ! X = 1722.333, -110.650,   38.10,  12.2,     0.41,  34.77,  278.2,  .0,
      0.00E+00, 0.00E+00, 2.31E+01, 0.00E+00, 1.94E-02,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
      0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 1.09E+02 !
```

```
   6 ! ZPLTFM  =       .0 !
   6 ! FMFAC  =      1.0 !   !END!

   7 ! SRCNAM = 908 !
   7 ! X = 1722.333, -110.650,   40.23,  12.2,     0.61,  18.27,  290.4,  .0,
       2.14E-02, 0.00E+00, 2.96E+01, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 1.74E-02, 9.85E-02, 1.49E+01 !
   7 ! ZPLTFM  =       .0 !
   7 ! FMFAC  =      1.0 !   !END!

   8 ! SRCNAM = 904 !
   8 ! X = 1722.333, -110.650,   35.05,  12.2,     0.61,  19.89,  278.2,  .0,
       0.00E+00, 0.00E+00, 2.31E+01, 0.00E+00, 1.94E-02,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 5.16E+01 !
   8 ! ZPLTFM  =       .0 !
   8 ! FMFAC  =      1.0 !   !END!

   9 ! SRCNAM = 909 !
   9 ! X = 1722.333, -110.650,   34.14,  12.2,     0.61,  23.46,  290.4,  .0,
       5.29E-02, 0.00E+00, 2.30E+01, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 1.57E-02, 8.92E-02, 1.57E+01 !
   9 ! ZPLTFM  =       .0 !
   9 ! FMFAC  =      1.0 !   !END!

  10 ! SRCNAM = 108 !
  10 ! X = 1722.333, -110.650,   56.39,  12.2,     1.52,  16.83,  310.9,  .0,
       5.87E+00, 6.30E-02, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00,
       0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00, 0.00E+00 !
  10 ! ZPLTFM  =       .0 !
  10 ! FMFAC  =      1.0 !   !END!
```

---

a
Data for each source are treated as a separate input subgroup
and therefore must end with an input group terminator.

SRCNAM is a 12-character name for a source
(No default)
X is an array holding the source data listed by the column headings
(No default)

SIGYZI is an array holding the initial sigma-y and sigma-z (m)
(Default: 0.,0.)
ZPLTFM is the platform height (m) for sources influenced by an isolated structure that has a significant open area between the surface and the bulk of the structure, such as an offshore oil platform. The Base Elevation is that of the surface (ground or ocean), and the Stack Height is the release height above the Base (not above the platform). Building heights entered in Subgroup 13c must be those of the buildings on the platform, measured from the platform deck. ZPLTFM is used only with MBDW=1 (ISC downwash method) for sources with building downwash.
(Default: 0.0)
FMFAC is a vertical momentum flux factor (0. or 1.0) used to represent the effect of rain-caps or other physical configurations that reduce momentum rise associated with the actual exit velocity.
(Default: 1.0 -- full momentum used)

b
0. = No building downwash modeled, 1. = downwash modeled
NOTE: must be entered as a REAL number (i.e., with decimal point)

c
An emission rate must be entered for every pollutant modeled.
Enter emission rate of zero for secondary pollutants that are modeled, but not emitted. Units are specified by IPTU
(e.g. 1 for g/s).

Subgroup (13c)

Source No.	BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH Effective building height, width, length and X/Y offset (in meters) every 10 degrees. LENGTH, XBADJ, and YBADJ are only needed for MBDW=2 (PRIME downwash option) [a]

---

a
Building height, width, length, and X/Y offset from the source are treated as a separate input subgroup for each source and therefore must end with an input group terminator. The X/Y offset is the position, relative to the stack, of the center of the upwind face of the projected building, with the x-axis pointing along the flow direction.

Subgroup (13d)
---

a
POINT SOURCE: VARIABLE EMISSIONS DATA

Use this subgroup to describe temporal variations in the emission rates given in 13b. Factors entered multiply the rates in 13b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use PTEMARB.DAT and NPT2 > 0.

IVARY determines the type of variation, and is source-specific:
(IVARY) Default: 0

0 =	Constant	
1 =	Diurnal cycle	(24 scaling factors: hours 1-24)
2 =	Monthly cycle	(12 scaling factors: months 1-12)
3 =	Hour & Season	(4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB)
4 =	Speed & Stab.	(6 groups of 6 scaling factors, where first group is Stability Class A, and the speed classes have upper bounds (m/s) defined in Group 12
5 =	Temperature	(12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)

---
a
Data for each species are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUPS: 14a, 14b, 14c, 14d -- Area source parameters

Subgroup (14a)

Number of polygon area sources with parameters specified below (NAR1) No default ! NAR1 = 0 !

```
     Units used for area source
     emissions below            (IARU)       Default: 1  !  IARU =   1  !
           1 =        g/m**2/s
           2 =       kg/m**2/hr
           3 =       lb/m**2/hr
           4 =     tons/m**2/yr
           5 =     Odour Unit * m/s  (vol. flux/m**2 of odour compound)
           6 =     Odour Unit * m/min
           7 =     metric tons/m**2/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (14d)        (NSAR1) Default: 0  !  NSAR1 =  0  !

     Number of buoyant polygon area sources
     with variable location and emission
     parameters (NAR2)                      No default  !  NAR2 =  0   !
     (If NAR2 > 0, ALL parameter data for
     these sources are read from the file: BAEMARB.DAT)

!END!

---------------
Subgroup (14b)
---------------
                                   a
          AREA SOURCE: CONSTANT DATA
          ---------------------------
                                                              b
Source           Effect.    Base      Initial    Emission
 No.             Height   Elevation   Sigma z     Rates
                   (m)       (m)        (m)
-------          ------    ------     --------   ---------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.
    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IARU
     (e.g. 1 for g/m**2/s).

---------------
Subgroup (14c)
---------------
```

```
           COORDINATES (km) FOR EACH VERTEX(4) OF EACH POLYGON
           ---------------------------------------------------
Source                                                          a
 No.       Ordered list of X followed by list of Y, grouped by source
------     ----------------------------------------------------------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.


---------------
Subgroup (14d)
---------------
                                          a
          AREA SOURCE: VARIABLE EMISSIONS DATA
          ------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 14b.  Factors entered multiply the rates in 14b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use BAEMARB.DAT and NAR2 > 0.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                              Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)



--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.
```

```
--------------------------------------------------------------------------------

INPUT GROUPS: 15a, 15b, 15c -- Line source parameters
---------------------------

---------------
Subgroup (15a)
---------------

     Number of buoyant line sources
     with variable location and emission
     parameters (NLN2)                          No default  !  NLN2 =  0   !

     (If NLN2 > 0, ALL parameter data for
      these sources are read from the file: LNEMARB.DAT)

     Number of buoyant line sources (NLINES)    No default   ! NLINES =  0  !

     Units used for line source
     emissions below            (ILNU)          Default: 1  !  ILNU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (15c)    (NSLN1) Default: 0  !  NSLN1 =  0  !

     Maximum number of segments used to model
     each line (MXNSEG)                         Default: 7   ! MXNSEG =  7  !

     The following variables are required only if NLINES > 0.  They are
     used in the buoyant line source plume rise calculations.

        Number of distances at which            Default: 6   ! NLRISE =  6  !
        transitional rise is computed

        Average building length (XL)            No default   ! XL = .0 !
                                                (in meters)

        Average building height (HBL)           No default   ! HBL = .0 !
                                                (in meters)
```

```
        Average building width (WBL)                No default   ! WBL = .0 !
                                                    (in meters)

        Average line source width (WML)             No default   ! WML = .0 !
                                                    (in meters)

        Average separation between buildings (DXL)  No default   ! DXL = .0 !
                                                    (in meters)

        Average buoyancy parameter (FPRIMEL)        No default   ! FPRIMEL = .0 !
                                                    (in m**4/s**3)

!END!

---------------
Subgroup (15b)
---------------

          BUOYANT LINE SOURCE: CONSTANT DATA
          ----------------------------------
                                                                                  a
Source     Beg. X      Beg. Y      End. X    End. Y     Release    Base        Emission
 No.     Coordinate  Coordinate  Coordinate Coordinate  Height    Elevation     Rates
           (km)        (km)        (km)       (km)       (m)       (m)
------   ----------  ----------  ---------  ----------  -------   ---------    ---------

--------

    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by ILNTU
     (e.g. 1 for g/s).

---------------
Subgroup (15c)
---------------
                                                 a
          BUOYANT LINE SOURCE: VARIABLE EMISSIONS DATA
          --------------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 15b.  Factors entered multiply the rates in 15b.
     Skip sources here that have constant emissions.
```

```
     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                  Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)



--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


------------------------------------------------------------------------------


INPUT GROUPS: 16a, 16b, 16c -- Volume source parameters
---------------------------

---------------
Subgroup (16a)
---------------

     Number of volume sources with
     parameters provided in 16b,c (NVL1)     No default  !  NVL1 =  0   !

     Units used for volume source
     emissions below in 16b       (IVLU)     Default: 1  !  IVLU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
```

```
     emissions scaling factors
     provided below in (16c)      (NSVL1)    Default: 0  !  NSVL1 =  0  !

     Number of volume sources with
     variable location and emission
     parameters                   (NVL2)     No default  !  NVL2 =   0   !

     (If NVL2 > 0, ALL parameter data for
      these sources are read from the VOLEMARB.DAT file(s) )

!END!

---------------
Subgroup (16b)
---------------
                                        a
           VOLUME SOURCE: CONSTANT DATA
           ----------------------------
                                                                        b
         X           Y        Effect.    Base     Initial    Initial    Emission
     Coordinate  Coordinate   Height   Elevation  Sigma y    Sigma z     Rates
        (km)        (km)        (m)       (m)       (m)        (m)
     ----------  ----------   ------    ------    --------   --------   --------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IVLU
     (e.g. 1 for g/s).

---------------
Subgroup (16c)
---------------
                                                 a
           VOLUME SOURCE: VARIABLE EMISSIONS DATA
           --------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 16b.  Factors entered multiply the rates in 16b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use VOLEMARB.DAT and NVL2 > 0.

     IVARY determines the type of variation, and is source-specific:
```

```
     (IVARY)                                Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)
```

---

a
Data for each species are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUPS: 17a & 17b -- Non-gridded (discrete) receptor information

---

Subgroup (17a)

Number of non-gridded receptors (NREC) No default ! NREC = 589 !

!END!

Subgroup (17b)

---

a

NON-GRIDDED (DISCRETE) RECEPTOR DATA

Receptor No.	X Coordinate (km)	Y Coordinate (km)	Ground Elevation (m)	Height Above Ground (m) b	
1 ! X =	1570.525,	-58.686,	700.0,	0.00, !	!END!
2 ! X =	1571.581,	-56.591,	626.0,	0.00, !	!END!

```
3 ! X =    1574.426,      -56.014,      781.0,      0.00, !  !END!
4 ! X =    1573.692,      -52.402,      515.0,      0.00, !  !END!
5 ! X =    1571.904,      -50.884,      607.0,      0.00, !  !END!
6 ! X =    1573.325,      -50.595,      557.0,      0.00, !  !END!
7 ! X =    1574.746,      -50.307,      676.0,      0.00, !  !END!
8 ! X =    1576.167,      -50.018,      541.0,      0.00, !  !END!
9 ! X =    1571.538,      -49.078,      586.0,      0.00, !  !END!
10 ! X =    1572.959,      -48.789,      767.0,      0.00, !  !END!
11 ! X =    1574.379,      -48.501,      708.0,      0.00, !  !END!
12 ! X =    1575.800,      -48.212,      430.0,      0.00, !  !END!
13 ! X =    1572.592,      -46.983,      563.0,      0.00, !  !END!
14 ! X =    1574.012,      -46.695,      830.0,      0.00, !  !END!
15 ! X =    1575.433,      -46.406,      564.0,      0.00, !  !END!
16 ! X =    1576.853,      -46.117,      434.0,      0.00, !  !END!
17 ! X =    1570.805,      -45.465,      452.0,      0.00, !  !END!
18 ! X =    1572.225,      -45.177,      582.0,      0.00, !  !END!
19 ! X =    1573.645,      -44.888,      739.0,      0.00, !  !END!
20 ! X =    1575.065,      -44.600,      821.0,      0.00, !  !END!
21 ! X =    1576.485,      -44.311,      451.0,      0.00, !  !END!
22 ! X =    1571.858,      -43.371,      761.0,      0.00, !  !END!
23 ! X =    1573.278,      -43.082,      733.0,      0.00, !  !END!
24 ! X =    1574.698,      -42.794,      823.0,      0.00, !  !END!
25 ! X =    1576.118,      -42.505,      602.0,      0.00, !  !END!
26 ! X =    1571.492,      -41.565,      507.0,      0.00, !  !END!
27 ! X =    1572.911,      -41.276,      474.0,      0.00, !  !END!
28 ! X =    1574.331,      -40.988,      602.0,      0.00, !  !END!
29 ! X =    1575.750,      -40.699,      734.0,      0.00, !  !END!
30 ! X =    1578.588,      -40.120,      602.0,      0.00, !  !END!
31 ! X =    1572.544,      -39.470,      623.0,      0.00, !  !END!
32 ! X =    1573.963,      -39.182,      742.0,      0.00, !  !END!
33 ! X =    1575.382,      -38.893,      749.0,      0.00, !  !END!
34 ! X =    1576.801,      -38.604,      764.0,      0.00, !  !END!
35 ! X =    1579.639,      -38.025,      534.0,      0.00, !  !END!
36 ! X =    1572.177,      -37.664,      616.0,      0.00, !  !END!
37 ! X =    1573.596,      -37.376,      704.0,      0.00, !  !END!
38 ! X =    1575.014,      -37.087,      726.0,      0.00, !  !END!
39 ! X =    1576.433,      -36.798,      792.0,      0.00, !  !END!
40 ! X =    1577.852,      -36.509,      706.0,      0.00, !  !END!
41 ! X =    1579.270,      -36.219,      481.0,      0.00, !  !END!
42 ! X =    1570.392,      -36.146,      412.0,      0.00, !  !END!
43 ! X =    1571.810,      -35.858,      461.0,      0.00, !  !END!
44 ! X =    1573.228,      -35.570,      742.0,      0.00, !  !END!
45 ! X =    1574.647,      -35.281,      493.0,      0.00, !  !END!
46 ! X =    1576.065,      -34.992,      556.0,      0.00, !  !END!
47 ! X =    1577.483,      -34.703,      781.0,      0.00, !  !END!
48 ! X =    1578.901,      -34.413,      823.0,      0.00, !  !END!
49 ! X =    1580.320,      -34.124,      854.0,      0.00, !  !END!
50 ! X =    1581.738,      -33.834,      818.0,      0.00, !  !END!
51 ! X =    1583.156,      -33.543,      631.0,      0.00, !  !END!
```

```
52 ! X =    1572.861,      -33.764,      539.0,      0.00, !  !END!
53 ! X =    1574.279,      -33.475,      649.0,      0.00, !  !END!
54 ! X =    1575.697,      -33.186,      737.0,      0.00, !  !END!
55 ! X =    1577.115,      -32.897,      612.0,      0.00, !  !END!
56 ! X =    1578.533,      -32.608,      582.0,      0.00, !  !END!
57 ! X =    1579.951,      -32.318,      650.0,      0.00, !  !END!
58 ! X =    1581.368,      -32.028,      829.0,      0.00, !  !END!
59 ! X =    1582.786,      -31.738,      825.0,      0.00, !  !END!
60 ! X =    1584.204,      -31.448,      482.0,      0.00, !  !END!
61 ! X =    1573.911,      -31.669,      609.0,      0.00, !  !END!
62 ! X =    1575.329,      -31.380,      585.0,      0.00, !  !END!
63 ! X =    1576.746,      -31.091,      757.0,      0.00, !  !END!
64 ! X =    1578.164,      -30.802,      458.0,      0.00, !  !END!
65 ! X =    1579.581,      -30.512,      582.0,      0.00, !  !END!
66 ! X =    1580.999,      -30.222,      825.0,      0.00, !  !END!
67 ! X =    1582.416,      -29.932,      691.0,      0.00, !  !END!
68 ! X =    1583.834,      -29.642,      427.0,      0.00, !  !END!
69 ! X =    1574.961,      -29.574,      472.0,      0.00, !  !END!
70 ! X =    1576.378,      -29.285,      721.0,      0.00, !  !END!
71 ! X =    1577.795,      -28.996,      459.0,      0.00, !  !END!
72 ! X =    1579.212,      -28.707,      824.0,      0.00, !  !END!
73 ! X =    1580.630,      -28.417,      728.0,      0.00, !  !END!
74 ! X =    1582.047,      -28.127,      764.0,      0.00, !  !END!
75 ! X =    1583.464,      -27.837,      769.0,      0.00, !  !END!
76 ! X =    1584.880,      -27.546,      859.0,      0.00, !  !END!
77 ! X =    1577.427,      -27.190,      457.0,      0.00, !  !END!
78 ! X =    1578.843,      -26.901,      575.0,      0.00, !  !END!
79 ! X =    1580.260,      -26.611,      548.0,      0.00, !  !END!
80 ! X =    1581.677,      -26.321,      661.0,      0.00, !  !END!
81 ! X =    1583.094,      -26.031,      547.0,      0.00, !  !END!
82 ! X =    1584.510,      -25.741,      821.0,      0.00, !  !END!
83 ! X =    1585.927,      -25.450,      691.0,      0.00, !  !END!
84 ! X =    1579.891,      -24.806,      538.0,      0.00, !  !END!
85 ! X =    1581.307,      -24.516,      649.0,      0.00, !  !END!
86 ! X =    1585.556,      -23.645,      579.0,      0.00, !  !END!
87 ! X =    1586.972,      -23.354,      821.0,      0.00, !  !END!
88 ! X =    1588.388,      -23.063,      913.0,      0.00, !  !END!
89 ! X =    1589.804,      -22.771,      890.0,      0.00, !  !END!
90 ! X =    1579.521,      -23.000,      430.0,      0.00, !  !END!
91 ! X =    1580.937,      -22.710,      516.0,      0.00, !  !END!
92 ! X =    1582.353,      -22.420,      458.0,      0.00, !  !END!
93 ! X =    1588.017,      -21.257,      671.0,      0.00, !  !END!
94 ! X =    1589.433,      -20.966,      750.0,      0.00, !  !END!
95 ! X =    1590.848,      -20.674,      541.0,      0.00, !  !END!
96 ! X =    1592.264,      -20.383,      429.0,      0.00, !  !END!
97 ! X =    1581.983,      -20.615,      457.0,      0.00, !  !END!
98 ! X =    1583.399,      -20.325,      488.0,      0.00, !  !END!
99 ! X =    1584.815,      -20.034,      412.0,      0.00, !  !END!
100 ! X =    1586.230,      -19.743,      465.0,      0.00, !  !END!
```

```
101 ! X =    1587.646,      -19.452,      624.0,      0.00, !  !END!
102 ! X =    1589.061,      -19.161,      763.0,      0.00, !  !END!
103 ! X =    1590.476,      -18.869,      849.0,      0.00, !  !END!
104 ! X =    1591.892,      -18.578,      820.0,      0.00, !  !END!
105 ! X =    1593.307,      -18.286,      893.0,      0.00, !  !END!
106 ! X =    1583.029,      -18.519,      456.0,      0.00, !  !END!
107 ! X =    1588.689,      -17.356,      544.0,      0.00, !  !END!
108 ! X =    1590.104,      -17.064,      827.0,      0.00, !  !END!
109 ! X =    1591.519,      -16.773,      796.0,      0.00, !  !END!
110 ! X =    1592.934,      -16.481,      579.0,      0.00, !  !END!
111 ! X =    1589.732,      -15.259,      710.0,      0.00, !  !END!
112 ! X =    1591.147,      -14.968,      983.0,      0.00, !  !END!
113 ! X =    1592.561,      -14.676,      943.0,      0.00, !  !END!
114 ! X =    1593.976,      -14.384,      790.0,      0.00, !  !END!
115 ! X =    1595.390,      -14.091,      700.0,      0.00, !  !END!
116 ! X =    1587.946,      -13.746,      455.0,      0.00, !  !END!
117 ! X =    1590.775,      -13.163,      631.0,      0.00, !  !END!
118 ! X =    1592.189,      -12.871,      979.0,      0.00, !  !END!
119 ! X =    1593.603,      -12.579,      716.0,      0.00, !  !END!
120 ! X =    1595.017,      -12.286,      709.0,      0.00, !  !END!
121 ! X =    1596.431,      -11.994,      452.0,      0.00, !  !END!
122 ! X =    1588.988,      -11.649,      519.0,      0.00, !  !END!
123 ! X =    1591.816,      -11.066,      717.0,      0.00, !  !END!
124 ! X =    1593.230,      -10.774,      950.0,      0.00, !  !END!
125 ! X =    1591.443,      -9.261,      653.0,      0.00, !  !END!
126 ! X =    1592.857,      -8.969,      908.0,      0.00, !  !END!
127 ! X =    1594.270,      -8.677,      977.0,      0.00, !  !END!
128 ! X =    1595.684,      -8.384,      792.0,      0.00, !  !END!
129 ! X =    1601.337,      -7.212,      398.0,      0.00, !  !END!
130 ! X =    1602.750,      -6.918,      395.0,      0.00, !  !END!
131 ! X =    1591.071,      -7.456,      486.0,      0.00, !  !END!
132 ! X =    1592.484,      -7.164,      618.0,      0.00, !  !END!
133 ! X =    1593.897,      -6.872,      934.0,      0.00, !  !END!
134 ! X =    1595.310,      -6.580,      700.0,      0.00, !  !END!
135 ! X =    1598.136,      -5.994,      800.0,      0.00, !  !END!
136 ! X =    1600.962,      -5.407,      579.0,      0.00, !  !END!
137 ! X =    1602.375,      -5.114,      475.0,      0.00, !  !END!
138 ! X =    1586.459,      -6.526,      768.0,      0.00, !  !END!
139 ! X =    1592.111,      -5.360,      579.0,      0.00, !  !END!
140 ! X =    1593.524,      -5.068,      869.0,      0.00, !  !END!
141 ! X =    1594.937,      -4.775,      1059.0,      0.00, !  !END!
142 ! X =    1596.349,      -4.483,      871.0,      0.00, !  !END!
143 ! X =    1586.088,      -4.721,      627.0,      0.00, !  !END!
144 ! X =    1587.500,      -4.430,      695.0,      0.00, !  !END!
145 ! X =    1588.913,      -4.138,      600.0,      0.00, !  !END!
146 ! X =    1590.325,      -3.847,      601.0,      0.00, !  !END!
147 ! X =    1591.738,      -3.555,      831.0,      0.00, !  !END!
148 ! X =    1593.150,      -3.263,      844.0,      0.00, !  !END!
149 ! X =    1594.563,      -2.971,      1033.0,      0.00, !  !END!
```

```
150 ! X =    1595.975,      -2.678,      915.0,      0.00, !  !END!
151 ! X =    1597.388,      -2.385,      775.0,      0.00, !  !END!
152 ! X =    1584.303,      -3.206,      507.0,      0.00, !  !END!
153 ! X =    1585.716,      -2.916,      611.0,      0.00, !  !END!
154 ! X =    1594.189,      -1.166,      1018.0,      0.00, !  !END!
155 ! X =    1595.601,      -0.873,      1066.0,      0.00, !  !END!
156 ! X =    1597.013,      -0.581,      1017.0,      0.00, !  !END!
157 ! X =    1598.425,      -0.288,      614.0,      0.00, !  !END!
158 ! X =    1599.837,      0.006,      407.0,      0.00, !  !END!
159 ! X =    1604.072,      0.887,      317.0,      0.00, !  !END!
160 ! X =    1593.816,      0.639,      1025.0,      0.00, !  !END!
161 ! X =    1595.227,      0.931,      1031.0,      0.00, !  !END!
162 ! X =    1596.639,      1.224,      767.0,      0.00, !  !END!
163 ! X =    1598.051,      1.517,      833.0,      0.00, !  !END!
164 ! X =    1599.462,      1.810,      833.0,      0.00, !  !END!
165 ! X =    1600.874,      2.103,      500.0,      0.00, !  !END!
166 ! X =    1603.696,      2.691,      628.0,      0.00, !  !END!
167 ! X =    1605.108,      2.985,      569.0,      0.00, !  !END!
168 ! X =    1594.853,      2.736,      579.0,      0.00, !  !END!
169 ! X =    1596.265,      3.028,      975.0,      0.00, !  !END!
170 ! X =    1597.676,      3.321,      1123.0,      0.00, !  !END!
171 ! X =    1599.087,      3.614,      858.0,      0.00, !  !END!
172 ! X =    1600.498,      3.908,      628.0,      0.00, !  !END!
173 ! X =    1603.320,      4.495,      750.0,      0.00, !  !END!
174 ! X =    1604.731,      4.789,      777.0,      0.00, !  !END!
175 ! X =    1606.142,      5.084,      446.0,      0.00, !  !END!
176 ! X =    1595.890,      4.833,      893.0,      0.00, !  !END!
177 ! X =    1597.301,      5.126,      813.0,      0.00, !  !END!
178 ! X =    1598.712,      5.419,      1036.0,      0.00, !  !END!
179 ! X =    1600.123,      5.712,      770.0,      0.00, !  !END!
180 ! X =    1601.534,      6.006,      735.0,      0.00, !  !END!
181 ! X =    1602.944,      6.299,      567.0,      0.00, !  !END!
182 ! X =    1604.355,      6.593,      514.0,      0.00, !  !END!
183 ! X =    1605.766,      6.888,      466.0,      0.00, !  !END!
184 ! X =    1596.927,      6.930,      720.0,      0.00, !  !END!
185 ! X =    1598.337,      7.223,      1005.0,      0.00, !  !END!
186 ! X =    1599.748,      7.516,      975.0,      0.00, !  !END!
187 ! X =    1601.158,      7.810,      854.0,      0.00, !  !END!
188 ! X =    1602.568,      8.103,      732.0,      0.00, !  !END!
189 ! X =    1603.979,      8.398,      463.0,      0.00, !  !END!
190 ! X =    1605.389,      8.692,      355.0,      0.00, !  !END!
191 ! X =    1596.552,      8.734,      888.0,      0.00, !  !END!
192 ! X =    1597.962,      9.027,      1085.0,      0.00, !  !END!
193 ! X =    1599.372,      9.320,      1043.0,      0.00, !  !END!
194 ! X =    1600.782,      9.614,      749.0,      0.00, !  !END!
195 ! X =    1602.192,      9.908,      572.0,      0.00, !  !END!
196 ! X =    1603.602,      10.202,      458.0,      0.00, !  !END!
197 ! X =    1605.012,      10.496,      640.0,      0.00, !  !END!
198 ! X =    1606.422,      10.790,      450.0,      0.00, !  !END!
```

```
199 ! X =    1596.177,      10.539,      468.0,      0.00, !  !END!
200 ! X =    1597.587,      10.832,      600.0,      0.00, !  !END!
201 ! X =    1598.997,      11.125,      942.0,      0.00, !  !END!
202 ! X =    1600.407,      11.418,      830.0,      0.00, !  !END!
203 ! X =    1601.817,      11.712,      915.0,      0.00, !  !END!
204 ! X =    1603.226,      12.006,      730.0,      0.00, !  !END!
205 ! X =    1604.636,      12.300,      778.0,      0.00, !  !END!
206 ! X =    1606.045,      12.594,      689.0,      0.00, !  !END!
207 ! X =    1598.622,      12.929,      618.0,      0.00, !  !END!
208 ! X =    1600.031,      13.222,      761.0,      0.00, !  !END!
209 ! X =    1601.441,      13.516,      1090.0,      0.00, !  !END!
210 ! X =    1602.850,      13.810,      810.0,      0.00, !  !END!
211 ! X =    1604.259,      14.104,      701.0,      0.00, !  !END!
212 ! X =    1605.668,      14.398,      578.0,      0.00, !  !END!
213 ! X =    1607.078,      14.693,      508.0,      0.00, !  !END!
214 ! X =    1601.065,      15.320,      743.0,      0.00, !  !END!
215 ! X =    1602.474,      15.614,      913.0,      0.00, !  !END!
216 ! X =    1603.883,      15.908,      535.0,      0.00, !  !END!
217 ! X =    1605.291,      16.202,      425.0,      0.00, !  !END!
218 ! X =    1606.700,      16.497,      315.0,      0.00, !  !END!
219 ! X =    1596.462,      16.244,      436.0,      0.00, !  !END!
220 ! X =    1599.280,      16.831,      447.0,      0.00, !  !END!
221 ! X =    1600.689,      17.124,      675.0,      0.00, !  !END!
222 ! X =    1602.097,      17.418,      672.0,      0.00, !  !END!
223 ! X =    1603.506,      17.712,      440.0,      0.00, !  !END!
224 ! X =    1604.915,      18.006,      464.0,      0.00, !  !END!
225 ! X =    1600.313,      18.928,      738.0,      0.00, !  !END!
226 ! X =    1601.721,      19.222,      832.0,      0.00, !  !END!
227 ! X =    1603.129,      19.516,      611.0,      0.00, !  !END!
228 ! X =    1604.538,      19.810,      507.0,      0.00, !  !END!
229 ! X =    1595.712,      19.853,      476.0,      0.00, !  !END!
230 ! X =    1597.121,      20.146,      778.0,      0.00, !  !END!
231 ! X =    1599.937,      20.732,      643.0,      0.00, !  !END!
232 ! X =    1601.345,      21.026,      695.0,      0.00, !  !END!
233 ! X =    1602.753,      21.320,      426.0,      0.00, !  !END!
234 ! X =    1604.161,      21.614,      367.0,      0.00, !  !END!
235 ! X =    1593.929,      21.365,      338.0,      0.00, !  !END!
236 ! X =    1595.337,      21.657,      336.0,      0.00, !  !END!
237 ! X =    1596.745,      21.950,      395.0,      0.00, !  !END!
238 ! X =    1598.153,      22.243,      436.0,      0.00, !  !END!
239 ! X =    1599.561,      22.536,      701.0,      0.00, !  !END!
240 ! X =    1600.968,      22.830,      568.0,      0.00, !  !END!
241 ! X =    1602.376,      23.123,      528.0,      0.00, !  !END!
242 ! X =    1603.784,      23.417,      448.0,      0.00, !  !END!
243 ! X =    1605.191,      23.712,      625.0,      0.00, !  !END!
244 ! X =    1606.599,      24.006,      431.0,      0.00, !  !END!
245 ! X =    1596.370,      23.754,      582.0,      0.00, !  !END!
246 ! X =    1597.777,      24.047,      791.0,      0.00, !  !END!
247 ! X =    1599.185,      24.340,      589.0,      0.00, !  !END!
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248 ! X =    1600.592,      24.634,      586.0,      0.00, !  !END!
249 ! X =    1601.999,      24.927,      694.0,      0.00, !  !END!
250 ! X =    1603.407,      25.221,      638.0,      0.00, !  !END!
251 ! X =    1604.814,      25.516,      432.0,      0.00, !  !END!
252 ! X =    1597.402,      25.851,      571.0,      0.00, !  !END!
253 ! X =    1598.809,      26.144,      582.0,      0.00, !  !END!
254 ! X =    1600.216,      26.438,      661.0,      0.00, !  !END!
255 ! X =    1601.623,      26.731,      923.0,      0.00, !  !END!
256 ! X =    1603.030,      27.025,      794.0,      0.00, !  !END!
257 ! X =    1604.437,      27.319,      715.0,      0.00, !  !END!
258 ! X =    1611.470,      28.794,      526.0,      0.00, !  !END!
259 ! X =    1599.840,      28.242,      684.0,      0.00, !  !END!
260 ! X =    1601.246,      28.535,      848.0,      0.00, !  !END!
261 ! X =    1602.653,      28.829,      1006.0,      0.00, !  !END!
262 ! X =    1604.059,      29.123,      771.0,      0.00, !  !END!
263 ! X =    1605.466,      29.417,      753.0,      0.00, !  !END!
264 ! X =    1606.872,      29.712,      786.0,      0.00, !  !END!
265 ! X =    1608.279,      30.007,      740.0,      0.00, !  !END!
266 ! X =    1609.685,      30.302,      637.0,      0.00, !  !END!
267 ! X =    1611.091,      30.597,      607.0,      0.00, !  !END!
268 ! X =    1596.651,      29.460,      265.0,      0.00, !  !END!
269 ! X =    1598.057,      29.753,      368.0,      0.00, !  !END!
270 ! X =    1599.463,      30.046,      468.0,      0.00, !  !END!
271 ! X =    1600.870,      30.339,      647.0,      0.00, !  !END!
272 ! X =    1602.276,      30.633,      583.0,      0.00, !  !END!
273 ! X =    1605.088,      31.221,      450.0,      0.00, !  !END!
274 ! X =    1606.494,      31.516,      612.0,      0.00, !  !END!
275 ! X =    1607.900,      31.810,      712.0,      0.00, !  !END!
276 ! X =    1609.306,      32.105,      945.0,      0.00, !  !END!
277 ! X =    1610.712,      32.401,      693.0,      0.00, !  !END!
278 ! X =    1597.681,      31.557,      273.0,      0.00, !  !END!
279 ! X =    1599.087,      31.850,      336.0,      0.00, !  !END!
280 ! X =    1600.493,      32.143,      640.0,      0.00, !  !END!
281 ! X =    1601.899,      32.437,      607.0,      0.00, !  !END!
282 ! X =    1608.928,      33.909,      573.0,      0.00, !  !END!
283 ! X =    1610.333,      34.204,      781.0,      0.00, !  !END!
284 ! X =    1611.739,      34.500,      563.0,      0.00, !  !END!
285 ! X =    1597.305,      33.361,      247.0,      0.00, !  !END!
286 ! X =    1608.549,      35.712,      581.0,      0.00, !  !END!
287 ! X =    1609.954,      36.008,      736.0,      0.00, !  !END!
288 ! X =    1611.360,      36.303,      644.0,      0.00, !  !END!
289 ! X =    1608.171,      37.516,      474.0,      0.00, !  !END!
290 ! X =    1609.575,      37.811,      625.0,      0.00, !  !END!
291 ! X =    1610.980,      38.106,      660.0,      0.00, !  !END!
292 ! X =    1607.792,      39.319,      494.0,      0.00, !  !END!
293 ! X =    1609.197,      39.614,      462.0,      0.00, !  !END!
294 ! X =    1607.413,      41.123,      454.0,      0.00, !  !END!
295 ! X =    1605.631,      42.632,      444.0,      0.00, !  !END!
296 ! X =    1607.035,      42.927,      468.0,      0.00, !  !END!
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297 ! X =    1608.439,      43.221,      304.0,      0.00, !  !END!
298 ! X =    1606.656,      44.730,      306.0,      0.00, !  !END!
299 ! X =    1528.821,      -121.486,      735.0,      0.00, !  !END!
300 ! X =    1529.538,      -121.346,      762.0,      0.00, !  !END!
301 ! X =    1530.255,      -121.206,      771.0,      0.00, !  !END!
302 ! X =    1526.493,      -121.002,      480.0,      0.00, !  !END!
303 ! X =    1527.210,      -120.862,      610.0,      0.00, !  !END!
304 ! X =    1527.927,      -120.722,      460.0,      0.00, !  !END!
305 ! X =    1528.644,      -120.582,      560.0,      0.00, !  !END!
306 ! X =    1529.361,      -120.441,      678.0,      0.00, !  !END!
307 ! X =    1530.078,      -120.301,      731.0,      0.00, !  !END!
308 ! X =    1530.795,      -120.161,      792.0,      0.00, !  !END!
309 ! X =    1531.512,      -120.020,      612.0,      0.00, !  !END!
310 ! X =    1526.317,      -120.097,      484.0,      0.00, !  !END!
311 ! X =    1527.034,      -119.957,      619.0,      0.00, !  !END!
312 ! X =    1527.751,      -119.817,      696.0,      0.00, !  !END!
313 ! X =    1528.468,      -119.677,      608.0,      0.00, !  !END!
314 ! X =    1529.184,      -119.537,      759.0,      0.00, !  !END!
315 ! X =    1529.901,      -119.397,      791.0,      0.00, !  !END!
316 ! X =    1530.618,      -119.256,      503.0,      0.00, !  !END!
317 ! X =    1531.335,      -119.116,      398.0,      0.00, !  !END!
318 ! X =    1525.423,      -119.333,      447.0,      0.00, !  !END!
319 ! X =    1526.140,      -119.193,      544.0,      0.00, !  !END!
320 ! X =    1526.857,      -119.053,      604.0,      0.00, !  !END!
321 ! X =    1527.574,      -118.913,      789.0,      0.00, !  !END!
322 ! X =    1528.291,      -118.773,      770.0,      0.00, !  !END!
323 ! X =    1529.008,      -118.632,      739.0,      0.00, !  !END!
324 ! X =    1529.724,      -118.492,      609.0,      0.00, !  !END!
325 ! X =    1530.441,      -118.352,      463.0,      0.00, !  !END!
326 ! X =    1531.158,      -118.211,      457.0,      0.00, !  !END!
327 ! X =    1531.875,      -118.071,      390.0,      0.00, !  !END!
328 ! X =    1525.247,      -118.428,      347.0,      0.00, !  !END!
329 ! X =    1525.964,      -118.288,      465.0,      0.00, !  !END!
330 ! X =    1526.680,      -118.148,      609.0,      0.00, !  !END!
331 ! X =    1527.397,      -118.008,      551.0,      0.00, !  !END!
332 ! X =    1528.114,      -117.868,      670.0,      0.00, !  !END!
333 ! X =    1528.831,      -117.728,      470.0,      0.00, !  !END!
334 ! X =    1529.547,      -117.588,      397.0,      0.00, !  !END!
335 ! X =    1530.264,      -117.447,      425.0,      0.00, !  !END!
336 ! X =    1530.981,      -117.307,      333.0,      0.00, !  !END!
337 ! X =    1531.697,      -117.166,      360.0,      0.00, !  !END!
338 ! X =    1532.414,      -117.026,      363.0,      0.00, !  !END!
339 ! X =    1526.504,      -117.243,      441.0,      0.00, !  !END!
340 ! X =    1527.220,      -117.103,      491.0,      0.00, !  !END!
341 ! X =    1527.937,      -116.963,      569.0,      0.00, !  !END!
342 ! X =    1528.654,      -116.823,      303.0,      0.00, !  !END!
343 ! X =    1529.370,      -116.683,      254.0,      0.00, !  !END!
344 ! X =    1531.520,      -116.262,      333.0,      0.00, !  !END!
345 ! X =    1532.237,      -116.122,      214.0,      0.00, !  !END!
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346 ! X =    1527.044,      -116.199,      340.0,      0.00, !  !END!
347 ! X =    1527.760,      -116.059,      479.0,      0.00, !  !END!
348 ! X =    1528.477,      -115.919,      468.0,      0.00, !  !END!
349 ! X =    1529.193,      -115.778,      213.0,      0.00, !  !END!
350 ! X =    1528.300,      -115.014,      275.0,      0.00, !  !END!
351 ! X =    1857.330,      -305.922,      0.0,      0.00, !  !END!
352 ! X =    1858.064,      -305.752,      1.0,      0.00, !  !END!
353 ! X =    1857.122,      -305.023,      1.0,      0.00, !  !END!
354 ! X =    1857.856,      -304.852,      1.0,      0.00, !  !END!
355 ! X =    1856.913,      -304.123,      0.0,      0.00, !  !END!
356 ! X =    1848.632,      -305.092,      0.0,      0.00, !  !END!
357 ! X =    1844.755,      -305.040,      0.0,      0.00, !  !END!
358 ! X =    1856.496,      -302.324,      0.0,      0.00, !  !END!
359 ! X =    1857.229,      -302.154,      1.0,      0.00, !  !END!
360 ! X =    1857.963,      -301.984,      1.0,      0.00, !  !END!
361 ! X =    1861.631,      -301.131,      1.0,      0.00, !  !END!
362 ! X =    1862.364,      -300.960,      1.0,      0.00, !  !END!
363 ! X =    1863.831,      -300.619,      1.0,      0.00, !  !END!
364 ! X =    1864.565,      -300.448,      1.0,      0.00, !  !END!
365 ! X =    1846.015,      -303.801,      1.0,      0.00, !  !END!
366 ! X =    1850.418,      -302.784,      1.0,      0.00, !  !END!
367 ! X =    1854.086,      -301.935,      0.0,      0.00, !  !END!
368 ! X =    1854.820,      -301.765,      0.0,      0.00, !  !END!
369 ! X =    1855.553,      -301.595,      1.0,      0.00, !  !END!
370 ! X =    1856.287,      -301.425,      1.0,      0.00, !  !END!
371 ! X =    1857.020,      -301.255,      1.0,      0.00, !  !END!
372 ! X =    1857.754,      -301.084,      1.0,      0.00, !  !END!
373 ! X =    1860.688,      -300.402,      0.0,      0.00, !  !END!
374 ! X =    1861.421,      -300.232,      1.0,      0.00, !  !END!
375 ! X =    1862.155,      -300.061,      1.0,      0.00, !  !END!
376 ! X =    1862.888,      -299.890,      1.0,      0.00, !  !END!
377 ! X =    1863.622,      -299.719,      1.0,      0.00, !  !END!
378 ! X =    1845.074,      -303.071,      0.0,      0.00, !  !END!
379 ! X =    1845.808,      -302.902,      1.0,      0.00, !  !END!
380 ! X =    1847.275,      -302.563,      1.0,      0.00, !  !END!
381 ! X =    1848.743,      -302.224,      1.0,      0.00, !  !END!
382 ! X =    1856.078,      -300.525,      1.0,      0.00, !  !END!
383 ! X =    1856.812,      -300.355,      1.0,      0.00, !  !END!
384 ! X =    1857.545,      -300.185,      1.0,      0.00, !  !END!
385 ! X =    1859.745,      -299.674,      0.0,      0.00, !  !END!
386 ! X =    1860.479,      -299.503,      1.0,      0.00, !  !END!
387 ! X =    1861.212,      -299.332,      1.0,      0.00, !  !END!
388 ! X =    1843.399,      -302.509,      0.0,      0.00, !  !END!
389 ! X =    1844.133,      -302.340,      1.0,      0.00, !  !END!
390 ! X =    1844.867,      -302.171,      1.0,      0.00, !  !END!
391 ! X =    1848.535,      -301.324,      0.0,      0.00, !  !END!
392 ! X =    1849.268,      -301.155,      1.0,      0.00, !  !END!
393 ! X =    1856.603,      -299.456,      1.0,      0.00, !  !END!
394 ! X =    1857.336,      -299.286,      1.0,      0.00, !  !END!
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395 ! X =    1858.803,      -298.945,      1.0,      0.00, !  !END!
396 ! X =    1859.536,      -298.774,      1.0,      0.00, !  !END!
397 ! X =    1848.327,      -300.425,      1.0,      0.00, !  !END!
398 ! X =    1856.394,      -298.556,      1.0,      0.00, !  !END!
399 ! X =    1858.594,      -298.045,      1.0,      0.00, !  !END!
400 ! X =    1859.327,      -297.875,      1.0,      0.00, !  !END!
401 ! X =    1859.118,      -296.976,      1.0,      0.00, !  !END!
402 ! X =    1859.851,      -296.805,      1.0,      0.00, !  !END!
403 ! X =    1504.741,      31.554,      916.0,      0.00, !  !END!
404 ! X =    1505.444,      31.692,      1069.0,      0.00, !  !END!
405 ! X =    1506.147,      31.830,      1175.0,      0.00, !  !END!
406 ! X =    1506.850,      31.968,      1216.0,      0.00, !  !END!
407 ! X =    1503.860,      32.320,      824.0,      0.00, !  !END!
408 ! X =    1504.563,      32.458,      952.0,      0.00, !  !END!
409 ! X =    1505.266,      32.596,      1049.0,      0.00, !  !END!
410 ! X =    1505.969,      32.734,      1127.0,      0.00, !  !END!
411 ! X =    1506.672,      32.872,      1171.0,      0.00, !  !END!
412 ! X =    1507.375,      33.010,      1219.0,      0.00, !  !END!
413 ! X =    1508.078,      33.149,      1202.0,      0.00, !  !END!
414 ! X =    1502.980,      33.086,      1058.0,      0.00, !  !END!
415 ! X =    1503.683,      33.224,      967.0,      0.00, !  !END!
416 ! X =    1504.386,      33.362,      828.0,      0.00, !  !END!
417 ! X =    1505.089,      33.500,      851.0,      0.00, !  !END!
418 ! X =    1505.792,      33.638,      856.0,      0.00, !  !END!
419 ! X =    1506.494,      33.776,      974.0,      0.00, !  !END!
420 ! X =    1507.197,      33.914,      1077.0,      0.00, !  !END!
421 ! X =    1507.900,      34.053,      1148.0,      0.00, !  !END!
422 ! X =    1508.603,      34.191,      1188.0,      0.00, !  !END!
423 ! X =    1503.506,      34.128,      1116.0,      0.00, !  !END!
424 ! X =    1504.208,      34.266,      1004.0,      0.00, !  !END!
425 ! X =    1504.911,      34.404,      1097.0,      0.00, !  !END!
426 ! X =    1505.614,      34.542,      994.0,      0.00, !  !END!
427 ! X =    1506.317,      34.680,      954.0,      0.00, !  !END!
428 ! X =    1507.019,      34.818,      930.0,      0.00, !  !END!
429 ! X =    1507.722,      34.957,      1110.0,      0.00, !  !END!
430 ! X =    1508.425,      35.095,      1163.0,      0.00, !  !END!
431 ! X =    1503.328,      35.032,      1145.0,      0.00, !  !END!
432 ! X =    1504.031,      35.170,      1112.0,      0.00, !  !END!
433 ! X =    1504.734,      35.308,      1100.0,      0.00, !  !END!
434 ! X =    1505.436,      35.446,      1073.0,      0.00, !  !END!
435 ! X =    1506.139,      35.584,      1127.0,      0.00, !  !END!
436 ! X =    1506.842,      35.723,      1005.0,      0.00, !  !END!
437 ! X =    1507.544,      35.861,      1050.0,      0.00, !  !END!
438 ! X =    1508.247,      35.999,      1135.0,      0.00, !  !END!
439 ! X =    1508.949,      36.137,      1211.0,      0.00, !  !END!
440 ! X =    1503.151,      35.937,      1147.0,      0.00, !  !END!
441 ! X =    1503.853,      36.075,      1127.0,      0.00, !  !END!
442 ! X =    1504.556,      36.212,      1123.0,      0.00, !  !END!
443 ! X =    1505.259,      36.350,      1108.0,      0.00, !  !END!
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444 ! X =    1505.961,      36.489,      1126.0,      0.00, !  !END!
445 ! X =    1506.664,      36.627,      1015.0,      0.00, !  !END!
446 ! X =    1507.366,      36.765,      1144.0,      0.00, !  !END!
447 ! X =    1508.069,      36.903,      1109.0,      0.00, !  !END!
448 ! X =    1508.771,      37.041,      1201.0,      0.00, !  !END!
449 ! X =    1503.676,      36.979,      1154.0,      0.00, !  !END!
450 ! X =    1504.379,      37.117,      1128.0,      0.00, !  !END!
451 ! X =    1505.081,      37.255,      1135.0,      0.00, !  !END!
452 ! X =    1505.784,      37.393,      1158.0,      0.00, !  !END!
453 ! X =    1506.486,      37.531,      1090.0,      0.00, !  !END!
454 ! X =    1507.189,      37.669,      1153.0,      0.00, !  !END!
455 ! X =    1507.891,      37.807,      1157.0,      0.00, !  !END!
456 ! X =    1508.593,      37.945,      1166.0,      0.00, !  !END!
457 ! X =    1509.296,      38.084,      1168.0,      0.00, !  !END!
458 ! X =    1503.499,      37.883,      1137.0,      0.00, !  !END!
459 ! X =    1504.201,      38.021,      1127.0,      0.00, !  !END!
460 ! X =    1504.903,      38.159,      1156.0,      0.00, !  !END!
461 ! X =    1505.606,      38.297,      1158.0,      0.00, !  !END!
462 ! X =    1506.308,      38.435,      1110.0,      0.00, !  !END!
463 ! X =    1507.011,      38.573,      1097.0,      0.00, !  !END!
464 ! X =    1508.415,      38.849,      1159.0,      0.00, !  !END!
465 ! X =    1509.118,      38.988,      1188.0,      0.00, !  !END!
466 ! X =    1504.023,      38.925,      1128.0,      0.00, !  !END!
467 ! X =    1504.726,      39.063,      1157.0,      0.00, !  !END!
468 ! X =    1479.243,      23.778,      1127.0,      0.00, !  !END!
469 ! X =    1479.947,      23.914,      1088.0,      0.00, !  !END!
470 ! X =    1480.651,      24.050,      1006.0,      0.00, !  !END!
471 ! X =    1481.354,      24.185,      973.0,      0.00, !  !END!
472 ! X =    1482.058,      24.321,      945.0,      0.00, !  !END!
473 ! X =    1482.762,      24.457,      1043.0,      0.00, !  !END!
474 ! X =    1479.069,      24.683,      1139.0,      0.00, !  !END!
475 ! X =    1479.772,      24.819,      1090.0,      0.00, !  !END!
476 ! X =    1480.476,      24.954,      1071.0,      0.00, !  !END!
477 ! X =    1481.180,      25.090,      974.0,      0.00, !  !END!
478 ! X =    1481.883,      25.226,      1017.0,      0.00, !  !END!
479 ! X =    1482.587,      25.362,      1072.0,      0.00, !  !END!
480 ! X =    1483.291,      25.498,      1095.0,      0.00, !  !END!
481 ! X =    1481.005,      25.995,      1068.0,      0.00, !  !END!
482 ! X =    1481.709,      26.131,      938.0,      0.00, !  !END!
483 ! X =    1482.412,      26.267,      914.0,      0.00, !  !END!
484 ! X =    1483.116,      26.403,      1016.0,      0.00, !  !END!
485 ! X =    1483.819,      26.539,      1079.0,      0.00, !  !END!
486 ! X =    1480.127,      26.764,      1006.0,      0.00, !  !END!
487 ! X =    1480.830,      26.900,      975.0,      0.00, !  !END!
488 ! X =    1481.534,      27.035,      1034.0,      0.00, !  !END!
489 ! X =    1482.237,      27.171,      960.0,      0.00, !  !END!
490 ! X =    1482.941,      27.307,      929.0,      0.00, !  !END!
491 ! X =    1483.644,      27.443,      1091.0,      0.00, !  !END!
492 ! X =    1484.348,      27.579,      1084.0,      0.00, !  !END!
```

```
493 ! X =    1479.249,      27.533,      1120.0,      0.00, !  !END!
494 ! X =    1479.952,      27.669,      1065.0,      0.00, !  !END!
495 ! X =    1480.656,      27.804,      1058.0,      0.00, !  !END!
496 ! X =    1481.359,      27.940,      1036.0,      0.00, !  !END!
497 ! X =    1482.063,      28.076,      1006.0,      0.00, !  !END!
498 ! X =    1482.766,      28.212,      916.0,      0.00, !  !END!
499 ! X =    1483.469,      28.348,      895.0,      0.00, !  !END!
500 ! X =    1484.173,      28.484,      951.0,      0.00, !  !END!
501 ! X =    1479.075,      28.438,      1148.0,      0.00, !  !END!
502 ! X =    1479.778,      28.573,      1100.0,      0.00, !  !END!
503 ! X =    1480.481,      28.709,      1056.0,      0.00, !  !END!
504 ! X =    1481.184,      28.845,      1017.0,      0.00, !  !END!
505 ! X =    1481.888,      28.981,      939.0,      0.00, !  !END!
506 ! X =    1482.591,      29.117,      912.0,      0.00, !  !END!
507 ! X =    1483.294,      29.253,      853.0,      0.00, !  !END!
508 ! X =    1483.997,      29.389,      937.0,      0.00, !  !END!
509 ! X =    1484.701,      29.525,      1039.0,      0.00, !  !END!
510 ! X =    1478.900,      29.342,      1126.0,      0.00, !  !END!
511 ! X =    1479.603,      29.478,      1092.0,      0.00, !  !END!
512 ! X =    1480.307,      29.614,      1068.0,      0.00, !  !END!
513 ! X =    1481.010,      29.749,      1038.0,      0.00, !  !END!
514 ! X =    1481.713,      29.885,      986.0,      0.00, !  !END!
515 ! X =    1482.416,      30.021,      931.0,      0.00, !  !END!
516 ! X =    1483.119,      30.157,      829.0,      0.00, !  !END!
517 ! X =    1483.822,      30.293,      954.0,      0.00, !  !END!
518 ! X =    1484.526,      30.429,      1065.0,      0.00, !  !END!
519 ! X =    1485.229,      30.565,      1096.0,      0.00, !  !END!
520 ! X =    1479.429,      30.383,      1064.0,      0.00, !  !END!
521 ! X =    1480.132,      30.518,      1034.0,      0.00, !  !END!
522 ! X =    1480.835,      30.654,      979.0,      0.00, !  !END!
523 ! X =    1481.538,      30.790,      942.0,      0.00, !  !END!
524 ! X =    1482.241,      30.926,      870.0,      0.00, !  !END!
525 ! X =    1482.944,      31.062,      830.0,      0.00, !  !END!
526 ! X =    1483.647,      31.198,      941.0,      0.00, !  !END!
527 ! X =    1484.350,      31.334,      1038.0,      0.00, !  !END!
528 ! X =    1485.053,      31.470,      1104.0,      0.00, !  !END!
529 ! X =    1485.757,      31.606,      1132.0,      0.00, !  !END!
530 ! X =    1478.551,      31.152,      986.0,      0.00, !  !END!
531 ! X =    1479.254,      31.287,      1032.0,      0.00, !  !END!
532 ! X =    1479.957,      31.423,      1006.0,      0.00, !  !END!
533 ! X =    1480.660,      31.559,      1022.0,      0.00, !  !END!
534 ! X =    1481.363,      31.695,      1003.0,      0.00, !  !END!
535 ! X =    1482.066,      31.831,      941.0,      0.00, !  !END!
536 ! X =    1482.769,      31.966,      830.0,      0.00, !  !END!
537 ! X =    1483.472,      32.102,      1012.0,      0.00, !  !END!
538 ! X =    1484.175,      32.239,      1036.0,      0.00, !  !END!
539 ! X =    1484.878,      32.375,      1073.0,      0.00, !  !END!
540 ! X =    1485.581,      32.511,      1098.0,      0.00, !  !END!
541 ! X =    1486.284,      32.647,      1095.0,      0.00, !  !END!
```

```
542 ! X =    1479.080,      32.192,      1064.0,      0.00, !  !END!
543 ! X =    1479.783,      32.328,      1067.0,      0.00, !  !END!
544 ! X =    1480.486,      32.464,      1050.0,      0.00, !  !END!
545 ! X =    1481.189,      32.599,      929.0,      0.00, !  !END!
546 ! X =    1481.891,      32.735,      781.0,      0.00, !  !END!
547 ! X =    1482.594,      32.871,      934.0,      0.00, !  !END!
548 ! X =    1483.297,      33.007,      1027.0,      0.00, !  !END!
549 ! X =    1484.000,      33.143,      1056.0,      0.00, !  !END!
550 ! X =    1484.703,      33.279,      1097.0,      0.00, !  !END!
551 ! X =    1485.406,      33.415,      1087.0,      0.00, !  !END!
552 ! X =    1486.109,      33.552,      878.0,      0.00, !  !END!
553 ! X =    1478.905,      33.097,      1041.0,      0.00, !  !END!
554 ! X =    1479.608,      33.232,      1040.0,      0.00, !  !END!
555 ! X =    1480.311,      33.368,      946.0,      0.00, !  !END!
556 ! X =    1481.014,      33.504,      818.0,      0.00, !  !END!
557 ! X =    1481.717,      33.640,      737.0,      0.00, !  !END!
558 ! X =    1482.419,      33.776,      997.0,      0.00, !  !END!
559 ! X =    1483.122,      33.912,      1044.0,      0.00, !  !END!
560 ! X =    1483.825,      34.048,      1037.0,      0.00, !  !END!
561 ! X =    1484.528,      34.184,      1034.0,      0.00, !  !END!
562 ! X =    1485.231,      34.320,      1065.0,      0.00, !  !END!
563 ! X =    1485.933,      34.456,      816.0,      0.00, !  !END!
564 ! X =    1486.636,      34.592,      695.0,      0.00, !  !END!
565 ! X =    1479.433,      34.137,      1068.0,      0.00, !  !END!
566 ! X =    1480.136,      34.273,      1039.0,      0.00, !  !END!
567 ! X =    1480.839,      34.409,      803.0,      0.00, !  !END!
568 ! X =    1481.542,      34.544,      835.0,      0.00, !  !END!
569 ! X =    1482.244,      34.680,      1033.0,      0.00, !  !END!
570 ! X =    1482.947,      34.816,      1048.0,      0.00, !  !END!
571 ! X =    1483.650,      34.952,      949.0,      0.00, !  !END!
572 ! X =    1484.353,      35.088,      860.0,      0.00, !  !END!
573 ! X =    1485.055,      35.225,      1006.0,      0.00, !  !END!
574 ! X =    1485.758,      35.361,      725.0,      0.00, !  !END!
575 ! X =    1479.259,      35.042,      933.0,      0.00, !  !END!
576 ! X =    1479.961,      35.178,      921.0,      0.00, !  !END!
577 ! X =    1480.664,      35.313,      774.0,      0.00, !  !END!
578 ! X =    1481.367,      35.449,      775.0,      0.00, !  !END!
579 ! X =    1482.069,      35.585,      862.0,      0.00, !  !END!
580 ! X =    1482.772,      35.721,      832.0,      0.00, !  !END!
581 ! X =    1483.475,      35.857,      789.0,      0.00, !  !END!
582 ! X =    1479.787,      36.082,      763.0,      0.00, !  !END!
583 ! X =    1480.489,      36.218,      757.0,      0.00, !  !END!
584 ! X =    1481.192,      36.354,      816.0,      0.00, !  !END!
585 ! X =    1481.894,      36.490,      807.0,      0.00, !  !END!
586 ! X =    1482.597,      36.626,      688.0,      0.00, !  !END!
587 ! X =    1481.017,      37.258,      1097.0,      0.00, !  !END!
588 ! X =    1481.720,      37.394,      990.0,      0.00, !  !END!
589 ! X =    1482.422,      37.530,      979.0,      0.00, !  !END!
```

---

a
Data for each receptor are treated as a separate input subgroup
and therefore must end with an input group terminator.

b
Receptor height above ground is optional. If no value is entered,
the receptor is placed on the ground.

SAMPLE POSTUTIL INPUT FILE

STEP 1 RE-PARTITIONING
HONYWLVAUT02A1.INP
HONYWLVAUT02B1.INP
HONYWLVAUT02C1.INP
4-KM REFINED ANALYSIS YEAR 2002

```
HONEYWELL HOPEWELL VIRGINIA
BART APPLICABILITY ANALYSIS 2002 - 4KM
JRF/SHEN/DS/OC/SQ ANALYSES
---------------- Run title (3 lines) ----------------------------------------

                    POSTUTIL MODEL CONTROL FILE
                    ---------------------------

------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

-------------
Subgroup (0a)
-------------

Output Files
------------

 File            Default File Name
 ----            -----------------
 List File       POSTUTIL.LST       ! UTLLST =S:\BART\HONYWLVA\4KM\HONYWLVAUT02A1.lst   !
 Data File       MODEL.DAT          ! UTLDAT =S:\BART\HONYWLVA\4KM\HONYWLVAUT02A1.con   !



Input Files
-----------

 A time-varying file of "background" concentrations can be included
 when the ammonia-limiting method (ALM) for setting the HNO3/NO3
 concentration partition is accomplished in 1 step.  This option
 is selected by setting MNITRATE=3 in Input Group 1.
 Species required in the "background" concentration file are:
 SO4, NO3, HNO3 and TNH3 (total NH3 = NH3gaseous + NH3particulate).

 File            Default File Name
 ----            -----------------
 BCKG File       BCKGALM.DAT         * BCKGALM =BCKGALM.DAT     *


 A number of CALPUFF data files may be processed in this application.
 The files may represent individual CALPUFF simulations that were made
 for a specific set of species and/or sources.  Specify the total number
 of CALPUFF runs you wish to combine, and provide the filename for each
 in subgroup 0b.

     Number of CALPUFF data files (NFILES)
```

```
                                    Default: 1       ! NFILES  = 1   !


 Meteorological data files are needed for the HNO3/NO3 partition option.
 Three types of meteorological data files can be used:
       METFM= 0 - CALMET.DAT
       METFM= 1 - 1-D file with RH, Temp and Rhoair timeseries
       METFM= 2 - 2-D files with either Rh, Temp or Rhoair in each
                  (3 2 D files are needed)
      The default is to use CALMET.DAT files.

                                    Default: 0       ! METFM   = 0   !


 Multiple meteorological data files may be used in sequence to span the
 processing period.  Specify the number of time-period files (NMET) that
 you need to use, and provide a filename for each in subgroup 0b.
 - NMET is 0 if no meteorological files are provided
 - NMET is 1 if METFM=1 (multiple file feature is not available)
 - NMET is 1 or more if METFM=0 or 2 (multiple CALMET files or 2DMET files)

     Number of meteorological data file time-periods (NMET)
                                    Default: 0       ! NMET    =  8   !



 All filenames will be converted to lower case if LCFILES = T
 Otherwise, if LCFILES = F, filenames will be converted to UPPER CASE

     Convert filenames to lower case?  Default: T     ! LCFILES = T !
         T = lower case
         F = UPPER CASE

!END!

------------------------------------------------------------
 NOTE: file/path names can be up to 70 characters in length
------------------------------------------------------------

-------------
Subgroup (0b)
-------------

NMET CALMET Data Files (METFM=0):

Input File      Default File Name
----------      -----------------
     1          MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-01A.DAT     !  !END!
     2          MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-01B.DAT     !  !END!
```

```
     3          MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-02A.DAT     !  !END!
     4          MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-02B.DAT     !  !END!
     5          MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-03A.DAT     !  !END!
     6          MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-03B.DAT     !  !END!
     7          MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-04A.DAT     !  !END!
     8          MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-04B.DAT     !  !END!


NMET 1-D Data Files (METFM=1):

Input File      Default File Name
----------      -----------------
   1            MET_1D.DAT         * MET1D   = MET_1D.DAT * *END*


NMET 2-D Data Files of Each Type (METFM=2):

Input File      Default File Name
----------      -----------------
   1            RHUMD.DAT          * M2DRHU  = RELHUM.DAT * *END*
   1            TEMP.DAT           * M2DTMP  = TEMP.DAT   * *END*
   1            RHOAIR.DAT         * M2DRHO  = RHOAIR.DAT * *END*


NFILES CALPUFF Data Files:

Input File      Default File Name
----------      -----------------
   1            CALPUFF.DAT        ! MODDAT =S:\BART\HONYWLVA\4KM\HONYWLVA02.con ! !END!


-------------
Note:  provide NMET lines of the form   * UTLMET = name * *END*

                                    or   * MET1D  = name * *END*

                                    or   * M2DRHU = name * *END*
                                  (and)  * M2DTMP = name * *END*
                                  (and)  * M2DRHO = name * *END*

       and NFILES lines of the form     * MODDAT = name * *END*

       where the * should be replaced with an exclamation point,
       the special delimiter character.


------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
```

```
--------------

     Starting date:    Year  (ISYR) --    No default   ! ISYR  = 2002 !
                       Month (ISMO) --    No default   ! ISMO  = 1    !
                       Day   (ISDY) --    No default   ! ISDY  = 1    !
                       Hour  (ISHR) --    No default   ! ISHR  = 1    !

     Number of periods to process
                                (NPER) -- No default   ! NPER  = 2880 !

     Number of species to process from CALPUFF runs
                            (NSPECINP) -- No default   ! NSPECINP = 20 !

     Number of species to write to output file
                            (NSPECOUT) -- No default   ! NSPECOUT = 20 !

     Number of species to compute from those modeled
     (must be no greater than NSPECOUT)
                            (NSPECCMP) -- No default   ! NSPECCMP = 0 !


 When multiple files are used, a species name may appear in more than
 one file.  Data for this species will be summed (appropriate if the
 CALPUFF runs use different source groups).  If this summing is not
 appropriate, remove duplicate species from the file(s).

     Stop run if duplicate species names
     are found? (MDUPLCT)            Default: 0       ! MDUPLCT  =  0  !
        0 = no  (i.e., duplicate species are summed)
        1 = yes (i.e., run is halted)

 Data for each species in a CALPUFF data file may also be scaled as
 they are read.  This can be done to alter the emission rate of all
 sources that were modeled in a particular CALPUFF application.
 The scaling factor for each species is entered in Subgroup (2d), for
 each file for which scaling is requested.

     Number of CALPUFF data files that will be scaled
     (must be no greater than NFILES)
     (NSCALED)                       Default: 0       ! NSCALED = 0 !


 Ammonia-Limiting Method Option to recompute the HNO3/NO3 concentration
 partition prior to performing other actions is controlled by MNITRATE.
 This option will NOT alter any deposition fluxes contained in the CALPUFF
 file(s).  Three partition selections are provided.  The first two are
 typically used in sequence (POSTUTIL is run more than once).  The first
 selection (MNITRATE=1) computes the partition for the TOTAL (all sources)
 concentration fields (SO4, NO3, HNO3; NH3), and the second (MNITRATE=2)
```

```
 uses this partition (from the previous application of POSTUTIL) to
 compute the partition for individual source groups.  The third selection
 (MNITRATE=3) can be used instead in a single POSTUTIL application if a
 file of background concentrations is provided (BCKGALM in Input Group 0).

 Required information for MNITRATE=1 includes:
          species NO3, HNO3, and SO4
          NH3 concentration(s)
          met. data file for RH and T

 Required information for MNITRATE=2 includes:
          species NO3 and HNO3 for a source group
          species NO3ALL and HNO3ALL for all source groups, properly
          partitioned

 Required information for MNITRATE=3 includes:
          species NO3, HNO3, and SO4 for a source group
          species NO3, HNO3, SO4 and TNH3 from the background BCKGALM file
          If TNH3 is not in the background BCKGALM file, monthly TNH3
          concentrations are used (BCKTNH3)
          TNH3= total NH3 = NH3gaseous+NH3particulate

     Recompute the HNO3/NO3 partition for concentrations?
     (MNITRATE)                    Default: 0       ! MNITRATE  =  1  !
        0 = no
        1 = yes, for all sources combined
        2 = yes, for a source group
        3 = yes, ALM application in one step


 SOURCE OF AMMONIA:

 Ammonia may be available as a modeled species in the CALPUFF files,
 and it may or may not be appropriate to use it for repartitioning NO3/HNO3
 (in option MNITRATE=1 or MNITRATE=3).  Its use is contolled by NH3TYP.
 When NH3 is listed as a processed species in Subgroup (2a), as one of
 the NSPECINP ASPECI entries, and the right option is chosen for NH3TYP,
 the NH3 modeled values from the CALPUFF concentration files will be used
 in the chemical equilibrium calculation.

 NH3TYP also controls when monthly background ammonia values are used.  Both
 gaseous (NH3) and total (TNH3=NH3gaseous+NH3particulate) ammonia can be provided
 monthly as BCKNH3/BCKTNH3.

     What is the input source of Ammonia?
     (NH3TYP)                      No Default       ! NH3TYP = 1  !
        0 = No background will be used.
            ONLY NH3 or TNH3 from the concentration
            files listed in Subgroup (2a&2b) as
```

a processed species will be used.
(Cannot be used with MNITRATE=3)

1 = NH3 Monthly averaged background (BCKNH3)
listed below will be added to NH3 from
concentration files listed in Subgroup (2a)

2 = NH3 from background concentration file BCKGALM
will be added to NH3 from concentration files
listed in Subgroup (2a&2b)
(ONLY possible for MNITRATE=3)

3 = NH3 Monthly averaged background (BCKNH3)
listed below will be used alone.

4 = NH3 from background concentration file BCKGALM
will be used alone
(ONLY possible for MNITRATE=3)

OPTION	NH3 or TNH3 CONC	BCKNH3 or BCKTNH3	TNH3/BCKGALM or BCKTNH3
0	X	0	0
1	X	X	0
2	X	0	X
3	0	X	0
4	0	0	X

Default monthly (12 values) background ammonia concentration (ppb)
used for HNO3/NO3 partition (need to choose one or the other):

Gaseous NH3 (BCKNH3) Default: -999
! BCKNH3 = 12*0.5 !

Total TNH3 (BCKTNH3) Default: -999
* BCKTNH3 = 1., 1., 1., 1.1, 1.4, 1.3, 1.3, 1.2, 4*1. *

If a single value is entered, this is used for all 12 months.
Month 1 is JANUARY, Month 12 is DECEMBER.

!END!

INPUT GROUP: 2 -- Species Processing Information

Subgroup (2a)

The following NSPECINP species will be processed:

```
! ASPECI =           SO2 !         !END!
! ASPECI =           SO4 !         !END!
! ASPECI =           NOX !         !END!
! ASPECI =          HNO3 !         !END!
! ASPECI =           NO3 !         !END!
! ASPECI =        POC081 !         !END!
! ASPECI =        POC056 !         !END!
! ASPECI =        PIC081 !         !END!
! ASPECI =        PIC056 !         !END!
! ASPECI =        PMC800 !         !END!
! ASPECI =        PMC425 !         !END!
! ASPECI =        PMF187 !         !END!
! ASPECI =        PMF112 !         !END!
! ASPECI =        PMF081 !         !END!
! ASPECI =        PMF056 !         !END!
! ASPECI =         EC187 !         !END!
! ASPECI =         EC112 !         !END!
! ASPECI =         EC081 !         !END!
! ASPECI =         EC056 !         !END!
! ASPECI =           NH3 !         !END!
```

Subgroup (2b)

The following NSPECOUT species will be written:

```
! ASPECO =           SO2 !         !END!
! ASPECO =           SO4 !         !END!
! ASPECO =           NOX !         !END!
! ASPECO =          HNO3 !         !END!
! ASPECO =           NO3 !         !END!
! ASPECO =        POC081 !         !END!
! ASPECO =        POC056 !         !END!
! ASPECO =        PIC081 !         !END!
! ASPECO =        PIC056 !         !END!
! ASPECO =        PMC800 !         !END!
! ASPECO =        PMC425 !         !END!
! ASPECO =        PMF187 !         !END!
```

```
! ASPECO =        PMF112 !         !END!
! ASPECO =        PMF081 !         !END!
! ASPECO =        PMF056 !         !END!
! ASPECO =         EC187 !         !END!
! ASPECO =         EC112 !         !END!
! ASPECO =         EC081 !         !END!
! ASPECO =         EC056 !         !END!
! ASPECO =           NH3 !         !END!

-------------
Subgroup (2c)
-------------

  The following NSPECCMP species will be computed by scaling and summing
  one or more of the processed input species.  Identify the name(s) of
  the computed species and provide the scaling factors for each of the
  NSPECINP input species (NSPECCMP groups of NSPECINP+1 lines each):

* *


-------------
Subgroup (2d)
-------------

  Each species in NSCALED CALPUFF data files may be scaled before being
  processed (e.g., to change the emission rate for all sources modeled
  in the run that produced a data file).  For each file, identify the
  file name and then provide the name(s) of the scaled species and the
  corresponding scaling factors (A,B where x' = Ax+B).

              A(Default=1.0)      B(Default=0.0)
              --------------      --------------

* MODDAT =NOFILES.DAT    *
*     SO2  =      1.1,                0.0   *
*     SO4  =      1.5,                0.0   *
*    HNO3  =      0.8,                0.0   *
*     NO3  =      0.1,                0.0   *
*END*
```

```
HONEYWELL HOPEWELL VIRGINIA
BART APPLICABILITY ANALYSIS 2002 - 4KM
JRF/SHEN/DS/OC/SQ ANALYSES
---------------- Run title (3 lines) ----------------------------------------

                    POSTUTIL MODEL CONTROL FILE
                    ---------------------------

------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

-------------
Subgroup (0a)
-------------

Output Files
------------

 File            Default File Name
 ----            -----------------
 List File       POSTUTIL.LST       ! UTLLST =S:\BART\HONYWLVA\4KM\HONYWLVAUT02B1.lst   !
 Data File       MODEL.DAT          ! UTLDAT =S:\BART\HONYWLVA\4KM\HONYWLVAUT02B1.con   !



Input Files
-----------

 A time-varying file of "background" concentrations can be included
 when the ammonia-limiting method (ALM) for setting the HNO3/NO3
 concentration partition is accomplished in 1 step.  This option
 is selected by setting MNITRATE=3 in Input Group 1.
 Species required in the "background" concentration file are:
 SO4, NO3, HNO3 and TNH3 (total NH3 = NH3gaseous + NH3particulate).

 File            Default File Name
 ----            -----------------
 BCKG File       BCKGALM.DAT         * BCKGALM =BCKGALM.DAT     *


 A number of CALPUFF data files may be processed in this application.
 The files may represent individual CALPUFF simulations that were made
 for a specific set of species and/or sources.  Specify the total number
 of CALPUFF runs you wish to combine, and provide the filename for each
 in subgroup 0b.

     Number of CALPUFF data files (NFILES)
```

```
                                    Default: 1       ! NFILES  = 1   !


 Meteorological data files are needed for the HNO3/NO3 partition option.
 Three types of meteorological data files can be used:
       METFM= 0 - CALMET.DAT
       METFM= 1 - 1-D file with RH, Temp and Rhoair timeseries
       METFM= 2 - 2-D files with either Rh, Temp or Rhoair in each
                  (3 2 D files are needed)
      The default is to use CALMET.DAT files.

                                    Default: 0       ! METFM   = 0   !


 Multiple meteorological data files may be used in sequence to span the
 processing period.  Specify the number of time-period files (NMET) that
 you need to use, and provide a filename for each in subgroup 0b.
 - NMET is 0 if no meteorological files are provided
 - NMET is 1 if METFM=1 (multiple file feature is not available)
 - NMET is 1 or more if METFM=0 or 2 (multiple CALMET files or 2DMET files)

     Number of meteorological data file time-periods (NMET)
                                    Default: 0       ! NMET    =  8   !



 All filenames will be converted to lower case if LCFILES = T
 Otherwise, if LCFILES = F, filenames will be converted to UPPER CASE

     Convert filenames to lower case?  Default: T     ! LCFILES = T !
         T = lower case
         F = UPPER CASE

!END!

------------------------------------------------------------
 NOTE: file/path names can be up to 70 characters in length
------------------------------------------------------------

-------------
Subgroup (0b)
-------------

NMET CALMET Data Files (METFM=0):

Input File      Default File Name
----------      -----------------
     1          MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-05A.DAT     !  !END!
     2          MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-05B.DAT     !  !END!
```

```
     3           MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-06A.DAT     !  !END!
     4           MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-06B.DAT     !  !END!
     5           MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-07A.DAT     !  !END!
     6           MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-07B.DAT     !  !END!
     7           MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-08A.DAT     !  !END!
     8           MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-08B.DAT     !  !END!


NMET 1-D Data Files (METFM=1):

Input File      Default File Name
----------      -----------------
   1            MET_1D.DAT         * MET1D   = MET_1D.DAT * *END*


NMET 2-D Data Files of Each Type (METFM=2):

Input File      Default File Name
----------      -----------------
   1            RHUMD.DAT          * M2DRHU  = RELHUM.DAT * *END*
   1            TEMP.DAT           * M2DTMP  = TEMP.DAT   * *END*
   1            RHOAIR.DAT         * M2DRHO  = RHOAIR.DAT * *END*


NFILES CALPUFF Data Files:

Input File      Default File Name
----------      -----------------
   1            CALPUFF.DAT        ! MODDAT =S:\BART\HONYWLVA\4KM\HONYWLVA02.con ! !END!


-------------
Note:  provide NMET lines of the form   * UTLMET = name * *END*

                                    or   * MET1D  = name * *END*

                                    or   * M2DRHU = name * *END*
                                  (and)  * M2DTMP = name * *END*
                                  (and)  * M2DRHO = name * *END*

       and NFILES lines of the form     * MODDAT = name * *END*

       where the * should be replaced with an exclamation point,
       the special delimiter character.


------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
```

```
--------------

     Starting date:    Year  (ISYR) --    No default   ! ISYR  = 2002 !
                       Month (ISMO) --    No default   ! ISMO  = 5    !
                       Day   (ISDY) --    No default   ! ISDY  = 1    !
                       Hour  (ISHR) --    No default   ! ISHR  = 1    !

     Number of periods to process
                                (NPER) -- No default   ! NPER  = 2952  !

     Number of species to process from CALPUFF runs
                            (NSPECINP) -- No default   ! NSPECINP = 20 !

     Number of species to write to output file
                            (NSPECOUT) -- No default   ! NSPECOUT = 20 !

     Number of species to compute from those modeled
     (must be no greater than NSPECOUT)
                            (NSPECCMP) -- No default   ! NSPECCMP = 0 !


 When multiple files are used, a species name may appear in more than
 one file.  Data for this species will be summed (appropriate if the
 CALPUFF runs use different source groups).  If this summing is not
 appropriate, remove duplicate species from the file(s).

     Stop run if duplicate species names
     are found? (MDUPLCT)            Default: 0       ! MDUPLCT  =  0  !
        0 = no  (i.e., duplicate species are summed)
        1 = yes (i.e., run is halted)

 Data for each species in a CALPUFF data file may also be scaled as
 they are read.  This can be done to alter the emission rate of all
 sources that were modeled in a particular CALPUFF application.
 The scaling factor for each species is entered in Subgroup (2d), for
 each file for which scaling is requested.

     Number of CALPUFF data files that will be scaled
     (must be no greater than NFILES)
     (NSCALED)                       Default: 0       ! NSCALED = 0 !


 Ammonia-Limiting Method Option to recompute the HNO3/NO3 concentration
 partition prior to performing other actions is controlled by MNITRATE.
 This option will NOT alter any deposition fluxes contained in the CALPUFF
 file(s).  Three partition selections are provided.  The first two are
 typically used in sequence (POSTUTIL is run more than once).  The first
 selection (MNITRATE=1) computes the partition for the TOTAL (all sources)
 concentration fields (SO4, NO3, HNO3; NH3), and the second (MNITRATE=2)
```

```
 uses this partition (from the previous application of POSTUTIL) to
 compute the partition for individual source groups.  The third selection
 (MNITRATE=3) can be used instead in a single POSTUTIL application if a
 file of background concentrations is provided (BCKGALM in Input Group 0).

 Required information for MNITRATE=1 includes:
          species NO3, HNO3, and SO4
          NH3 concentration(s)
          met. data file for RH and T

 Required information for MNITRATE=2 includes:
          species NO3 and HNO3 for a source group
          species NO3ALL and HNO3ALL for all source groups, properly
          partitioned

 Required information for MNITRATE=3 includes:
          species NO3, HNO3, and SO4 for a source group
          species NO3, HNO3, SO4 and TNH3 from the background BCKGALM file
          If TNH3 is not in the background BCKGALM file, monthly TNH3
          concentrations are used (BCKTNH3)
          TNH3= total NH3 = NH3gaseous+NH3particulate

     Recompute the HNO3/NO3 partition for concentrations?
     (MNITRATE)                    Default: 0       ! MNITRATE  =  1  !
        0 = no
        1 = yes, for all sources combined
        2 = yes, for a source group
        3 = yes, ALM application in one step


 SOURCE OF AMMONIA:

 Ammonia may be available as a modeled species in the CALPUFF files,
 and it may or may not be appropriate to use it for repartitioning NO3/HNO3
 (in option MNITRATE=1 or MNITRATE=3).  Its use is contolled by NH3TYP.
 When NH3 is listed as a processed species in Subgroup (2a), as one of
 the NSPECINP ASPECI entries, and the right option is chosen for NH3TYP,
 the NH3 modeled values from the CALPUFF concentration files will be used
 in the chemical equilibrium calculation.

 NH3TYP also controls when monthly background ammonia values are used.  Both
 gaseous (NH3) and total (TNH3=NH3gaseous+NH3particulate) ammonia can be provided
 monthly as BCKNH3/BCKTNH3.

     What is the input source of Ammonia?
     (NH3TYP)                      No Default       ! NH3TYP = 1  !
        0 = No background will be used.
            ONLY NH3 or TNH3 from the concentration
            files listed in Subgroup (2a&2b) as
```

a processed species will be used.
(Cannot be used with MNITRATE=3)

1 = NH3 Monthly averaged background (BCKNH3)
listed below will be added to NH3 from
concentration files listed in Subgroup (2a)

2 = NH3 from background concentration file BCKGALM
will be added to NH3 from concentration files
listed in Subgroup (2a&2b)
(ONLY possible for MNITRATE=3)

3 = NH3 Monthly averaged background (BCKNH3)
listed below will be used alone.

4 = NH3 from background concentration file BCKGALM
will be used alone
(ONLY possible for MNITRATE=3)

OPTION	NH3 or TNH3 CONC	BCKNH3 or BCKTNH3	TNH3/BCKGALM or BCKTNH3
0	X	0	0
1	X	X	0
2	X	0	X
3	0	X	0
4	0	0	X

Default monthly (12 values) background ammonia concentration (ppb)
used for HNO3/NO3 partition (need to choose one or the other):

Gaseous NH3 (BCKNH3) Default: -999
! BCKNH3 = 12*0.5 !

Total TNH3 (BCKTNH3) Default: -999
* BCKTNH3 = 1., 1., 1., 1.1, 1.4, 1.3, 1.3, 1.2, 4*1. *

If a single value is entered, this is used for all 12 months.
Month 1 is JANUARY, Month 12 is DECEMBER.

!END!

INPUT GROUP: 2 -- Species Processing Information

```
--------------

-------------
Subgroup (2a)
-------------

  The following NSPECINP species will be processed:

! ASPECI =           SO2 !         !END!
! ASPECI =           SO4 !         !END!
! ASPECI =           NOX !         !END!
! ASPECI =          HNO3 !         !END!
! ASPECI =           NO3 !         !END!
! ASPECI =        POC081 !         !END!
! ASPECI =        POC056 !         !END!
! ASPECI =        PIC081 !         !END!
! ASPECI =        PIC056 !         !END!
! ASPECI =        PMC800 !         !END!
! ASPECI =        PMC425 !         !END!
! ASPECI =        PMF187 !         !END!
! ASPECI =        PMF112 !         !END!
! ASPECI =        PMF081 !         !END!
! ASPECI =        PMF056 !         !END!
! ASPECI =         EC187 !         !END!
! ASPECI =         EC112 !         !END!
! ASPECI =         EC081 !         !END!
! ASPECI =         EC056 !         !END!
! ASPECI =           NH3 !         !END!


-------------
Subgroup (2b)
-------------

  The following NSPECOUT species will be written:


! ASPECO =           SO2 !         !END!
! ASPECO =           SO4 !         !END!
! ASPECO =           NOX !         !END!
! ASPECO =          HNO3 !         !END!
! ASPECO =           NO3 !         !END!
! ASPECO =        POC081 !         !END!
! ASPECO =        POC056 !         !END!
! ASPECO =        PIC081 !         !END!
! ASPECO =        PIC056 !         !END!
! ASPECO =        PMC800 !         !END!
! ASPECO =        PMC425 !         !END!
! ASPECO =        PMF187 !         !END!
```

```
! ASPECO =        PMF112 !         !END!
! ASPECO =        PMF081 !         !END!
! ASPECO =        PMF056 !         !END!
! ASPECO =         EC187 !         !END!
! ASPECO =         EC112 !         !END!
! ASPECO =         EC081 !         !END!
! ASPECO =         EC056 !         !END!
! ASPECO =           NH3 !         !END!

-------------
Subgroup (2c)
-------------

  The following NSPECCMP species will be computed by scaling and summing
  one or more of the processed input species.  Identify the name(s) of
  the computed species and provide the scaling factors for each of the
  NSPECINP input species (NSPECCMP groups of NSPECINP+1 lines each):

* *


-------------
Subgroup (2d)
-------------

  Each species in NSCALED CALPUFF data files may be scaled before being
  processed (e.g., to change the emission rate for all sources modeled
  in the run that produced a data file).  For each file, identify the
  file name and then provide the name(s) of the scaled species and the
  corresponding scaling factors (A,B where x' = Ax+B).

              A(Default=1.0)      B(Default=0.0)
              --------------      --------------

* MODDAT =NOFILES.DAT    *
*     SO2  =      1.1,                0.0   *
*     SO4  =      1.5,                0.0   *
*    HNO3  =      0.8,                0.0   *
*     NO3  =      0.1,                0.0   *
*END*
```

```
HONEYWELL HOPEWELL VIRGINIA
BART APPLICABILITY ANALYSIS 2002 - 4KM
JRF/SHEN/DS/OC/SQ ANALYSES
---------------- Run title (3 lines) ------------------------------------------

                    POSTUTIL MODEL CONTROL FILE
                    ---------------------------

--------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

-------------
Subgroup (0a)
-------------

Output Files
------------

 File            Default File Name
 ----            -----------------
 List File       POSTUTIL.LST       ! UTLLST =S:\BART\HONYWLVA\4KM\HONYWLVAUT02C1.lst   !
 Data File       MODEL.DAT          ! UTLDAT =S:\BART\HONYWLVA\4KM\HONYWLVAUT02C1.con   !



Input Files
-----------

 A time-varying file of "background" concentrations can be included
 when the ammonia-limiting method (ALM) for setting the HNO3/NO3
 concentration partition is accomplished in 1 step.  This option
 is selected by setting MNITRATE=3 in Input Group 1.
 Species required in the "background" concentration file are:
 SO4, NO3, HNO3 and TNH3 (total NH3 = NH3gaseous + NH3particulate).

 File            Default File Name
 ----            -----------------
 BCKG File       BCKGALM.DAT         * BCKGALM =BCKGALM.DAT     *


 A number of CALPUFF data files may be processed in this application.
 The files may represent individual CALPUFF simulations that were made
 for a specific set of species and/or sources.  Specify the total number
 of CALPUFF runs you wish to combine, and provide the filename for each
 in subgroup 0b.

     Number of CALPUFF data files (NFILES)
```

```
                                    Default: 1       ! NFILES  = 1   !


 Meteorological data files are needed for the HNO3/NO3 partition option.
 Three types of meteorological data files can be used:
       METFM= 0 - CALMET.DAT
       METFM= 1 - 1-D file with RH, Temp and Rhoair timeseries
       METFM= 2 - 2-D files with either Rh, Temp or Rhoair in each
                  (3 2 D files are needed)
      The default is to use CALMET.DAT files.

                                    Default: 0       ! METFM   = 0   !


 Multiple meteorological data files may be used in sequence to span the
 processing period.  Specify the number of time-period files (NMET) that
 you need to use, and provide a filename for each in subgroup 0b.
 - NMET is 0 if no meteorological files are provided
 - NMET is 1 if METFM=1 (multiple file feature is not available)
 - NMET is 1 or more if METFM=0 or 2 (multiple CALMET files or 2DMET files)

     Number of meteorological data file time-periods (NMET)
                                    Default: 0       ! NMET    =  8   !



 All filenames will be converted to lower case if LCFILES = T
 Otherwise, if LCFILES = F, filenames will be converted to UPPER CASE

     Convert filenames to lower case?  Default: T     ! LCFILES = T !
         T = lower case
         F = UPPER CASE

!END!

------------------------------------------------------------
 NOTE: file/path names can be up to 70 characters in length
------------------------------------------------------------

-------------
Subgroup (0b)
-------------

NMET CALMET Data Files (METFM=0):

Input File      Default File Name
----------      -----------------
     1          MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-09A.DAT     !  !END!
     2          MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-09B.DAT     !  !END!
```

```
     3           MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-10A.DAT     !  !END!
     4           MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-10B.DAT     !  !END!
     5           MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-11A.DAT     !  !END!
     6           MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-11B.DAT     !  !END!
     7           MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-12A.DAT     !  !END!
     8           MET.DAT    ! UTLMET=M:\DOMAIN5\2002\MET2002-DOM5-12B.DAT     !  !END!


NMET 1-D Data Files (METFM=1):

Input File      Default File Name
----------      -----------------
   1            MET_1D.DAT         * MET1D   = MET_1D.DAT * *END*


NMET 2-D Data Files of Each Type (METFM=2):

Input File      Default File Name
----------      -----------------
   1            RHUMD.DAT          * M2DRHU  = RELHUM.DAT * *END*
   1            TEMP.DAT           * M2DTMP  = TEMP.DAT   * *END*
   1            RHOAIR.DAT         * M2DRHO  = RHOAIR.DAT * *END*


NFILES CALPUFF Data Files:

Input File      Default File Name
----------      -----------------
   1            CALPUFF.DAT        ! MODDAT =S:\BART\HONYWLVA\4KM\HONYWLVA02.con ! !END!


-------------
Note:  provide NMET lines of the form   * UTLMET = name * *END*

                                    or   * MET1D  = name * *END*

                                    or   * M2DRHU = name * *END*
                                  (and)  * M2DTMP = name * *END*
                                  (and)  * M2DRHO = name * *END*

       and NFILES lines of the form     * MODDAT = name * *END*

       where the * should be replaced with an exclamation point,
       the special delimiter character.


------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
```

```
--------------

     Starting date:    Year  (ISYR) --    No default   ! ISYR  = 2002 !
                       Month (ISMO) --    No default   ! ISMO  = 9    !
                       Day   (ISDY) --    No default   ! ISDY  = 1    !
                       Hour  (ISHR) --    No default   ! ISHR  = 1    !

     Number of periods to process
                                (NPER) -- No default   ! NPER  = 2928 !

     Number of species to process from CALPUFF runs
                            (NSPECINP) -- No default   ! NSPECINP = 20 !

     Number of species to write to output file
                            (NSPECOUT) -- No default   ! NSPECOUT = 20 !

     Number of species to compute from those modeled
     (must be no greater than NSPECOUT)
                            (NSPECCMP) -- No default   ! NSPECCMP = 0 !


 When multiple files are used, a species name may appear in more than
 one file.  Data for this species will be summed (appropriate if the
 CALPUFF runs use different source groups).  If this summing is not
 appropriate, remove duplicate species from the file(s).

     Stop run if duplicate species names
     are found? (MDUPLCT)            Default: 0       ! MDUPLCT  =  0  !
        0 = no  (i.e., duplicate species are summed)
        1 = yes (i.e., run is halted)

 Data for each species in a CALPUFF data file may also be scaled as
 they are read.  This can be done to alter the emission rate of all
 sources that were modeled in a particular CALPUFF application.
 The scaling factor for each species is entered in Subgroup (2d), for
 each file for which scaling is requested.

     Number of CALPUFF data files that will be scaled
     (must be no greater than NFILES)
     (NSCALED)                       Default: 0       ! NSCALED = 0 !


 Ammonia-Limiting Method Option to recompute the HNO3/NO3 concentration
 partition prior to performing other actions is controlled by MNITRATE.
 This option will NOT alter any deposition fluxes contained in the CALPUFF
 file(s).  Three partition selections are provided.  The first two are
 typically used in sequence (POSTUTIL is run more than once).  The first
 selection (MNITRATE=1) computes the partition for the TOTAL (all sources)
 concentration fields (SO4, NO3, HNO3; NH3), and the second (MNITRATE=2)
```

```
 uses this partition (from the previous application of POSTUTIL) to
 compute the partition for individual source groups.  The third selection
 (MNITRATE=3) can be used instead in a single POSTUTIL application if a
 file of background concentrations is provided (BCKGALM in Input Group 0).

 Required information for MNITRATE=1 includes:
          species NO3, HNO3, and SO4
          NH3 concentration(s)
          met. data file for RH and T

 Required information for MNITRATE=2 includes:
          species NO3 and HNO3 for a source group
          species NO3ALL and HNO3ALL for all source groups, properly
          partitioned

 Required information for MNITRATE=3 includes:
          species NO3, HNO3, and SO4 for a source group
          species NO3, HNO3, SO4 and TNH3 from the background BCKGALM file
          If TNH3 is not in the background BCKGALM file, monthly TNH3
          concentrations are used (BCKTNH3)
          TNH3= total NH3 = NH3gaseous+NH3particulate

     Recompute the HNO3/NO3 partition for concentrations?
     (MNITRATE)                    Default: 0       ! MNITRATE  =  1  !
        0 = no
        1 = yes, for all sources combined
        2 = yes, for a source group
        3 = yes, ALM application in one step


 SOURCE OF AMMONIA:

 Ammonia may be available as a modeled species in the CALPUFF files,
 and it may or may not be appropriate to use it for repartitioning NO3/HNO3
 (in option MNITRATE=1 or MNITRATE=3).  Its use is contolled by NH3TYP.
 When NH3 is listed as a processed species in Subgroup (2a), as one of
 the NSPECINP ASPECI entries, and the right option is chosen for NH3TYP,
 the NH3 modeled values from the CALPUFF concentration files will be used
 in the chemical equilibrium calculation.

 NH3TYP also controls when monthly background ammonia values are used.  Both
 gaseous (NH3) and total (TNH3=NH3gaseous+NH3particulate) ammonia can be provided
 monthly as BCKNH3/BCKTNH3.

     What is the input source of Ammonia?
     (NH3TYP)                      No Default       ! NH3TYP = 1  !
        0 = No background will be used.
            ONLY NH3 or TNH3 from the concentration
            files listed in Subgroup (2a&2b) as
```

a processed species will be used.
(Cannot be used with MNITRATE=3)

1 = NH3 Monthly averaged background (BCKNH3)
listed below will be added to NH3 from
concentration files listed in Subgroup (2a)

2 = NH3 from background concentration file BCKGALM
will be added to NH3 from concentration files
listed in Subgroup (2a&2b)
(ONLY possible for MNITRATE=3)

3 = NH3 Monthly averaged background (BCKNH3)
listed below will be used alone.

4 = NH3 from background concentration file BCKGALM
will be used alone
(ONLY possible for MNITRATE=3)

OPTION	NH3 or TNH3 CONC	BCKNH3 or BCKTNH3	TNH3/BCKGALM or BCKTNH3
0	X	0	0
1	X	X	0
2	X	0	X
3	0	X	0
4	0	0	X

Default monthly (12 values) background ammonia concentration (ppb)
used for HNO3/NO3 partition (need to choose one or the other):

Gaseous NH3 (BCKNH3) Default: -999
! BCKNH3 = 12*0.5 !

Total TNH3 (BCKTNH3) Default: -999
* BCKTNH3 = 1., 1., 1., 1.1, 1.4, 1.3, 1.3, 1.2, 4*1. *

If a single value is entered, this is used for all 12 months.
Month 1 is JANUARY, Month 12 is DECEMBER.

!END!

INPUT GROUP: 2 -- Species Processing Information

Subgroup (2a)

The following NSPECINP species will be processed:

```
! ASPECI =           SO2 !         !END!
! ASPECI =           SO4 !         !END!
! ASPECI =           NOX !         !END!
! ASPECI =          HNO3 !         !END!
! ASPECI =           NO3 !         !END!
! ASPECI =        POC081 !         !END!
! ASPECI =        POC056 !         !END!
! ASPECI =        PIC081 !         !END!
! ASPECI =        PIC056 !         !END!
! ASPECI =        PMC800 !         !END!
! ASPECI =        PMC425 !         !END!
! ASPECI =        PMF187 !         !END!
! ASPECI =        PMF112 !         !END!
! ASPECI =        PMF081 !         !END!
! ASPECI =        PMF056 !         !END!
! ASPECI =         EC187 !         !END!
! ASPECI =         EC112 !         !END!
! ASPECI =         EC081 !         !END!
! ASPECI =         EC056 !         !END!
! ASPECI =           NH3 !         !END!
```

Subgroup (2b)

The following NSPECOUT species will be written:

```
! ASPECO =           SO2 !         !END!
! ASPECO =           SO4 !         !END!
! ASPECO =           NOX !         !END!
! ASPECO =          HNO3 !         !END!
! ASPECO =           NO3 !         !END!
! ASPECO =        POC081 !         !END!
! ASPECO =        POC056 !         !END!
! ASPECO =        PIC081 !         !END!
! ASPECO =        PIC056 !         !END!
! ASPECO =        PMC800 !         !END!
! ASPECO =        PMC425 !         !END!
! ASPECO =        PMF187 !         !END!
```

```
! ASPECO =        PMF112 !         !END!
! ASPECO =        PMF081 !         !END!
! ASPECO =        PMF056 !         !END!
! ASPECO =         EC187 !         !END!
! ASPECO =         EC112 !         !END!
! ASPECO =         EC081 !         !END!
! ASPECO =         EC056 !         !END!
! ASPECO =           NH3 !         !END!

-------------
Subgroup (2c)
-------------

  The following NSPECCMP species will be computed by scaling and summing
  one or more of the processed input species.  Identify the name(s) of
  the computed species and provide the scaling factors for each of the
  NSPECINP input species (NSPECCMP groups of NSPECINP+1 lines each):

* *


-------------
Subgroup (2d)
-------------

  Each species in NSCALED CALPUFF data files may be scaled before being
  processed (e.g., to change the emission rate for all sources modeled
  in the run that produced a data file).  For each file, identify the
  file name and then provide the name(s) of the scaled species and the
  corresponding scaling factors (A,B where x' = Ax+B).

              A(Default=1.0)      B(Default=0.0)
              --------------      --------------

* MODDAT =NOFILES.DAT    *
*     SO2  =      1.1,                0.0   *
*     SO4  =      1.5,                0.0   *
*    HNO3  =      0.8,                0.0   *
*     NO3  =      0.1,                0.0   *
*END*
```

SAMPLE POSTUTIL INPUT FILE

STEP 2 POSTUTIL
HONYWLVAUT02.INP
4-KM REFINED ANALYSIS YEAR 2002

```
HONEYWELL HOPEWELL VIRGINIA
BART APPLICABILITY ANALYSIS - 4KM
JRF/SHEN/DS/OC/SQ ANALYSES
---------------- Run title (3 lines) ------------------------------------------

                    POSTUTIL MODEL CONTROL FILE
                    ---------------------------

--------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

-------------
Subgroup (0a)
-------------

Output Files
------------

 File            Default File Name
 ----            -----------------
 List File       POSTUTIL.LST       ! UTLLST =S:\BART\HONYWLVA\4KM\HONYWLVAUT02ALM.lst   !
 Data File       MODEL.DAT          ! UTLDAT =S:\BART\HONYWLVA\4KM\HONYWLVAUT02ALM.con   !



Input Files
-----------

 A time-varying file of "background" concentrations can be included
 when the ammonia-limiting method (ALM) for setting the HNO3/NO3
 concentration partition is accomplished in 1 step.  This option
 is selected by setting MNITRATE=3 in Input Group 1.
 Species required in the "background" concentration file are:
 SO4, NO3, HNO3 and TNH3 (total NH3 = NH3gaseous + NH3particulate).

 File            Default File Name
 ----            -----------------
 BCKG File       BCKGALM.DAT         * BCKGALM =BCKGALM.DAT     *


 A number of CALPUFF data files may be processed in this application.
 The files may represent individual CALPUFF simulations that were made
 for a specific set of species and/or sources.  Specify the total number
 of CALPUFF runs you wish to combine, and provide the filename for each
 in subgroup 0b.

     Number of CALPUFF data files (NFILES)
```

```
                                    Default: 1       ! NFILES  = 1   !


 Meteorological data files are needed for the HNO3/NO3 partition option.
 Three types of meteorological data files can be used:
       METFM= 0 - CALMET.DAT
       METFM= 1 - 1-D file with RH, Temp and Rhoair timeseries
       METFM= 2 - 2-D files with either Rh, Temp or Rhoair in each
                  (3 2 D files are needed)
      The default is to use CALMET.DAT files.

                                    Default: 0       ! METFM   = 0   !


 Multiple meteorological data files may be used in sequence to span the
 processing period.  Specify the number of time-period files (NMET) that
 you need to use, and provide a filename for each in subgroup 0b.
 - NMET is 0 if no meteorological files are provided
 - NMET is 1 if METFM=1 (multiple file feature is not available)
 - NMET is 1 or more if METFM=0 or 2 (multiple CALMET files or 2DMET files)

     Number of meteorological data file time-periods (NMET)
                                    Default: 0       ! NMET    = 0   !



 All filenames will be converted to lower case if LCFILES = T
 Otherwise, if LCFILES = F, filenames will be converted to UPPER CASE

     Convert filenames to lower case?  Default: T     ! LCFILES = T !
         T = lower case
         F = UPPER CASE

!END!

------------------------------------------------------------
 NOTE: file/path names can be up to 70 characters in length
------------------------------------------------------------

-------------
Subgroup (0b)
-------------

NMET CALMET Data Files (METFM=0):

Input File      Default File Name
----------      -----------------
   1            MET.DAT            * UTLMET =CALMET.DAT  * *END*
```

```
NMET 1-D Data Files (METFM=1):

Input File      Default File Name
----------      -----------------
   1            MET_1D.DAT         * MET1D   = MET_1D.DAT * *END*


NMET 2-D Data Files of Each Type (METFM=2):

Input File      Default File Name
----------      -----------------
   1            RHUMD.DAT          * M2DRHU  = RELHUM.DAT * *END*
   1            TEMP.DAT           * M2DTMP  = TEMP.DAT   * *END*
   1            RHOAIR.DAT         * M2DRHO  = RHOAIR.DAT * *END*


NFILES CALPUFF Data Files:

Input File      Default File Name
----------      -----------------
   1            CALPUFF.DAT        ! MODDAT =S:\BART\HONYWLVA\4KM\HONYWLVAUT02S1.con ! !END!


-------------
Note:  provide NMET lines of the form   * UTLMET = name * *END*

                                    or   * MET1D  = name * *END*

                                    or   * M2DRHU = name * *END*
                                  (and)  * M2DTMP = name * *END*
                                  (and)  * M2DRHO = name * *END*

       and NFILES lines of the form     * MODDAT = name * *END*

       where the * should be replaced with an exclamation point,
       the special delimiter character.


------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

     Starting date:    Year  (ISYR) --    No default   ! ISYR  =  2002 !
                       Month (ISMO) --    No default   ! ISMO  = 1    !
                       Day   (ISDY) --    No default   ! ISDY  = 1    !
                       Hour  (ISHR) --    No default   ! ISHR  = 1    !
```

```
    Number of periods to process
                              (NPER) -- No default   ! NPER  = 8760   !

    Number of species to process from CALPUFF runs
                           (NSPECINP) -- No default   ! NSPECINP = 20 !

    Number of species to write to output file
                           (NSPECOUT) -- No default   ! NSPECOUT = 10 !

    Number of species to compute from those modeled
    (must be no greater than NSPECOUT)
                           (NSPECCMP) -- No default   ! NSPECCMP = 4 !


When multiple files are used, a species name may appear in more than
one file.  Data for this species will be summed (appropriate if the
CALPUFF runs use different source groups).  If this summing is not
appropriate, remove duplicate species from the file(s).

    Stop run if duplicate species names
    are found? (MDUPLCT)           Default: 0       ! MDUPLCT  =  0  !
       0 = no  (i.e., duplicate species are summed)
       1 = yes (i.e., run is halted)

Data for each species in a CALPUFF data file may also be scaled as
they are read.  This can be done to alter the emission rate of all
sources that were modeled in a particular CALPUFF application.
The scaling factor for each species is entered in Subgroup (2d), for
each file for which scaling is requested.

    Number of CALPUFF data files that will be scaled
    (must be no greater than NFILES)
    (NSCALED)                      Default: 0       ! NSCALED = 0 !


Ammonia-Limiting Method Option to recompute the HNO3/NO3 concentration
partition prior to performing other actions is controlled by MNITRATE.
This option will NOT alter any deposition fluxes contained in the CALPUFF
file(s).  Three partition selections are provided.  The first two are
typically used in sequence (POSTUTIL is run more than once).  The first
selection (MNITRATE=1) computes the partition for the TOTAL (all sources)
concentration fields (SO4, NO3, HNO3; NH3), and the second (MNITRATE=2)
uses this partition (from the previous application of POSTUTIL) to
compute the partition for individual source groups.  The third selection
(MNITRATE=3) can be used instead in a single POSTUTIL application if a
file of background concentrations is provided (BCKGALM in Input Group 0).

Required information for MNITRATE=1 includes:
         species NO3, HNO3, and SO4
```

```
          NH3 concentration(s)
          met. data file for RH and T

 Required information for MNITRATE=2 includes:
          species NO3 and HNO3 for a source group
          species NO3ALL and HNO3ALL for all source groups, properly
          partitioned

 Required information for MNITRATE=3 includes:
          species NO3, HNO3, and SO4 for a source group
          species NO3, HNO3, SO4 and TNH3 from the background BCKGALM file
          If TNH3 is not in the background BCKGALM file, monthly TNH3
          concentrations are used (BCKTNH3)
          TNH3= total NH3 = NH3gaseous+NH3particulate

     Recompute the HNO3/NO3 partition for concentrations?
     (MNITRATE)                    Default: 0       ! MNITRATE  =  0  !
        0 = no
        1 = yes, for all sources combined
        2 = yes, for a source group
        3 = yes, ALM application in one step


 SOURCE OF AMMONIA:

 Ammonia may be available as a modeled species in the CALPUFF files,
 and it may or may not be appropriate to use it for repartitioning NO3/HNO3
 (in option MNITRATE=1 or MNITRATE=3).  Its use is contolled by NH3TYP.
 When NH3 is listed as a processed species in Subgroup (2a), as one of
 the NSPECINP ASPECI entries, and the right option is chosen for NH3TYP,
 the NH3 modeled values from the CALPUFF concentration files will be used
 in the chemical equilibrium calculation.

 NH3TYP also controls when monthly background ammonia values are used.  Both
 gaseous (NH3) and total (TNH3=NH3gaseous+NH3particulate) ammonia can be provided
 monthly as BCKNH3/BCKTNH3.

     What is the input source of Ammonia?
     (NH3TYP)                      No Default       ! NH3TYP = 3  !
        0 = No background will be used.
            ONLY NH3 or TNH3 from the concentration
            files listed in Subgroup (2a&2b) as
            a processed species will be used.
            (Cannot be used with MNITRATE=3)

        1 = NH3 Monthly averaged background (BCKNH3)
            listed below will be added to NH3 from
            concentration files listed in Subgroup (2a)
```

2 = NH3 from background concentration file BCKGALM
will be added to NH3 from concentration files
listed in Subgroup (2a&2b)
(ONLY possible for MNITRATE=3)

3 = NH3 Monthly averaged background (BCKNH3)
listed below will be used alone.

4 = NH3 from background concentration file BCKGALM
will be used alone
(ONLY possible for MNITRATE=3)

OPTION	NH3 or TNH3 CONC	BCKNH3 or BCKTNH3	TNH3/BCKGALM or BCKTNH3
0	X	0	0
1	X	X	0
2	X	0	X
3	0	X	0
4	0	0	X

Default monthly (12 values) background ammonia concentration (ppb)
used for HNO3/NO3 partition (need to choose one or the other):

Gaseous NH3 (BCKNH3) Default: -999
! BCKNH3 = 12*0.5 !

Total TNH3 (BCKTNH3) Default: -999
* BCKTNH3 = 1., 1., 1., 1.1, 1.4, 1.3, 1.3, 1.2, 4*1. *

If a single value is entered, this is used for all 12 months.
Month 1 is JANUARY, Month 12 is DECEMBER.

!END!

INPUT GROUP: 2 -- Species Processing Information

Subgroup (2a)

The following NSPECINP species will be processed:

```
! ASPECI =           SO2 !         !END!
! ASPECI =           SO4 !         !END!
! ASPECI =           NOX !         !END!
! ASPECI =          HNO3 !         !END!
! ASPECI =           NO3 !         !END!
! ASPECI =        POC081 !         !END!
! ASPECI =        POC056 !         !END!
! ASPECI =        PIC081 !         !END!
! ASPECI =        PIC056 !         !END!
! ASPECI =        PMC800 !         !END!
! ASPECI =        PMC425 !         !END!
! ASPECI =        PMF187 !         !END!
! ASPECI =        PMF112 !         !END!
! ASPECI =        PMF081 !         !END!
! ASPECI =        PMF056 !         !END!
! ASPECI =         EC187 !         !END!
! ASPECI =         EC112 !         !END!
! ASPECI =         EC081 !         !END!
! ASPECI =         EC056 !         !END!
! ASPECI =           NH3 !         !END!
```

Subgroup (2b)

The following NSPECOUT species will be written:

```
! ASPECO =            SO2 !         !END!
! ASPECO =            SO4 !         !END!
! ASPECO =            NOX !         !END!
! ASPECO =           HNO3 !         !END!
! ASPECO =            NO3 !         !END!
! ASPECO =             EC !         !END!
! ASPECO =           SOIL !         !END!
! ASPECO =            SOA !         !END!
! ASPECO =            PMC !         !END!
! ASPECO =            NH3 !         !END!
```

Subgroup (2c)

The following NSPECCMP species will be computed by scaling and summing one or more of the processed input species. Identify the name(s) of the computed species and provide the scaling factors for each of the NSPECINP input species (NSPECCMP groups of NSPECINP+1 lines each):

```
! CSPECCMP  =       EC  !
!    EC187  =   1.0000  !
!    EC112  =   1.0000  !
!    EC081  =   1.0000  !
!    EC056  =   1.0000  !
!END!

! CSPECCMP  =     SOIL  !
!   PMF187  =   1.0000  !
!   PMF112  =   1.0000  !
!   PMF081  =   1.0000  !
!   PMF056  =   1.0000  !
!   PIC081  =   1.0000  !
!   PIC056  =   1.0000  !
!END!

! CSPECCMP  =      SOA  !
!   POC081  =   1.0000  !
!   POC056  =   1.0000  !
!END!

! CSPECCMP  =      PMC  !
!   PMC800  =   1.0000  !
!   PMC425  =   1.0000  !
!END!


-------------
Subgroup (2d)
-------------

  Each species in NSCALED CALPUFF data files may be scaled before being
  processed (e.g., to change the emission rate for all sources modeled
  in the run that produced a data file).  For each file, identify the
  file name and then provide the name(s) of the scaled species and the
  corresponding scaling factors (A,B where x' = Ax+B).

              A(Default=1.0)      B(Default=0.0)
              --------------      --------------

* MODDAT =NOFILES.DAT    *
*     SO2  =      1.1,                0.0   *
*     SO4  =      1.5,                0.0   *
*    HNO3  =      0.8,                0.0   *
*     NO3  =      0.1,                0.0   *
*END*
```

SAMPLE CALPOST INPUT FILE

HONYWLVAVANSI02.INP
4-KM REFINED ANALYSIS YEAR 2002
SHENANDOAH ANNUAL AVERAGE NATURAL BACKGROUND

```
HONEYWELL HOPEWELL VIRGINIA
BART APPLICABILITY ANALYSIS - 4 km
SHENANDOAH VISTAS ANNUAL AVERAGE NATURAL BACKGROUND
---------------- Run title (3 lines) ------------------------------------------

                    CALPOST MODEL CONTROL FILE
                    --------------------------

-------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

Input Files
-----------

File                       Default File Name
----                       -----------------
Conc/Dep Flux File         MODEL.DAT          ! MODDAT =S:\BART\HONYWLVA\4KM\HONYWLVAUT02ALM.con   !
Relative Humidity File     VISB.DAT           * VISDAT =   *
Background Data File       BACK.DAT           * BACKDAT =  *
Transmissometer or         VSRN.DAT           * VSRDAT =   *
Nephelometer Data File      or
DATSAV Weather Data File    or
Prognostic Weather  File

Output Files
------------

File                       Default File Name
----                       -----------------
List File                  CALPOST.LST        ! PSTLST =S:\BART\HONYWLVA\4KM\HONYWLVAVANSH02.lst   !

Pathname for Timeseries Files   (blank)       * TSPATH =   *
(activate with exclamation points only if
providing NON-BLANK character string)

Pathname for Plot Files   (blank)             * PLPATH =   *
(activate with exclamation points only if
 providing NON-BLANK character string)

User Character String (U) to augment default filenames
(activate with exclamation points only if
 providing NON-BLANK character string)

Timeseries          TSERIES ASPEC ttHR CONC TSUNAM.DAT
Peak Value          PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT

                                           * TSUNAM =   *
```

```
Top Nth Rank Plot   RANK(ALL) ASPEC ttHR CONC TUNAM.DAT
                or  RANK(ii)_ASPEC_ttHR_CONC_TUNAM.GRD

                                          * TUNAM =   *

Exceedance Plot      EXCEED ASPEC ttHR CONC XUNAM.DAT
                 or  EXCEED_ASPEC_ttHR_CONC_XUNAM.GRD

                                          * XUNAM =   *

Echo Plot
(Specific Days)
           yyyy Mmm Ddd hh00(UTCszzzz) L00 ASPEC ttHR CONC.DAT
     or    yyyy_Mmm_Ddd_hh00(UTCszzzz)_L00_ASPEC_ttHR_CONC.GRD


Visibility Plot      DAILY_VISIB_VUNAM.DAT   * VUNAM =   *
(Daily Peak Summary)


Auxiliary Output Files
----------------------

File                      Default File Name
----                      -----------------
Visibility Change         DELVIS.DAT         ! DVISDAT =S:\BART\HONYWLVA\4KM\HONYWLVAVANSH02.del   !


-------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case               ! LCFILES = T !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 132 characters in length
NOTE: (2) Filenames for ALL PLOT and TIMESERIES FILES are constructed
          using a template that includes a pathname, user-supplied
          character(s), and context-specific strings, where
             ASPEC = Species Name
              CONC = CONC Or WFLX Or DFLX Or TFLX
                tt = Averaging Period (e.g. 03)
                ii = Rank (e.g. 02)
                hh = Hour(ending) in LST
             szzzz = Base time zone shift from UTC (EST is -0500)
              yyyy = Year(LST)
                mm = Month(LST)
                dd = day of month (LST)
          are determined internally based on selections made below.
          If a path or user-supplied character(s) are supplied, each
```

```
          must contain at least 1 non-blank character.

!END!
------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

     Option to run all periods found
     in the met. file(s)  (METRUN)        Default: 0   ! METRUN =   1  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in CALPUFF data file(s)

     Starting date:    Year  (ISYR) --    No default   ! ISYR  =  2002   !
     (used only if     Month (ISMO) --    No default   ! ISMO  =  0   !
      METRUN = 0)      Day   (ISDY) --    No default   ! ISDY  =  0   !
                       Hour  (ISHR) --    No default   ! ISHR  =  0   !

     Number of hours to process (NHRS) -- No default   ! NHRS  =  8760   !

     Process every hour of data?(NREP) -- Default: 1   ! NREP  =  1  !
      (1 = every hour processed,
       2 = every 2nd hour processed,
       5 = every 5th hour processed, etc.)

Species & Concentration/Deposition Information
----------------------------------------------

      Species to process (ASPEC)       -- No default   ! ASPEC = VISIB  !
      (ASPEC = VISIB for visibility processing)

      Layer/deposition code (ILAYER)   -- Default: 1   ! ILAYER =  1  !
        '1'  for CALPUFF concentrations,
        '-1' for dry deposition fluxes,
        '-2' for wet deposition fluxes,
        '-3' for wet+dry deposition fluxes.

      Scaling factors of the form:     -- Defaults:    ! A =  0.0    !
            X(new) = X(old) * A + B         A = 0.0    ! B =  0.0    !
        (NOT applied if A = B = 0.0)        B = 0.0

      Add Hourly Background Concentrations/Fluxes?
                             (LBACK)  -- Default: F   ! LBACK =  F !

Source information
------------------

  Option to process source contributions:
```

```
         0 =  Process only total reported contributions
         1 =  Sum all individual source contributions and process
         2 =  Run in TRACEBACK mode to identify source
              contributions at a SINGLE receptor
                          (MSOURCE) -- Default: 0   ! MSOURCE =  0  !

Receptor information
--------------------

  Gridded receptors processed?    (LG) -- Default: F   ! LG  = F  !
  Discrete receptors processed?   (LD) -- Default: F   ! LD  = T  !
  CTSG Complex terrain receptors processed?
                                 (LCT) -- Default: F   ! LCT = F  !

--Report results by DISCRETE receptor RING?
  (only used when LD = T)     (LDRING) -- Default: F   ! LDRING = F  !

--Select range of DISCRETE receptors (only used when LD = T):

  Select ALL DISCRETE receptors by setting NDRECP flag to -1;
                               OR
  Select SPECIFIC DISCRETE receptors by entering a flag (0,1) for each
     0 = discrete receptor not processed
     1 = discrete receptor processed
  using repeated value notation to select blocks of receptors:
     23*1, 15*0, 12*1
  Flag for all receptors after the last one assigned is set to 0
  (NDRECP) -- Default: -1
 ! NDRECP = 298*1, 52*0, 52*0  !


--Select range of GRIDDED receptors (only used when LG = T):

       X index of LL corner (IBGRID) -- Default: -1     ! IBGRID = -1  !
           (-1 OR 1 <= IBGRID <= NX)

       Y index of LL corner (JBGRID) -- Default: -1     ! JBGRID = -1  !
           (-1 OR 1 <= JBGRID <= NY)

       X index of UR corner (IEGRID) -- Default: -1     ! IEGRID = -1  !
           (-1 OR 1 <= IEGRID <= NX)

       Y index of UR corner (JEGRID) -- Default: -1     ! JEGRID = -1  !
           (-1 OR 1 <= JEGRID <= NY)

  Note: Entire grid is processed if IBGRID=JBGRID=IEGRID=JEGRID=-1


--Specific gridded receptors can also be excluded from CALPOST
```

```
  processing by filling a processing grid array with 0s and 1s.  If the
  processing flag for receptor index (i,j) is 1 (ON), that receptor
  will be processed if it lies within the range delineated by IBGRID,
  JBGRID,IEGRID,JEGRID and if LG=T. If it is 0 (OFF), it will not be
  processed in the run.  By default, all array values are set to 1 (ON).

  Number of gridded receptor rows provided in Subgroup (1a) to
  identify specific gridded receptors to process
                          (NGONOFF) -- Default: 0      ! NGONOFF =  0  !

!END!


--------------
Subgroup (1a) -- Specific gridded receptors included/excluded
--------------

    Specific gridded receptors are excluded from CALPOST processing
    by filling a processing grid array with 0s and 1s.  A total of
    NGONOFF lines are read here.  Each line corresponds to one 'row'
    in the sampling grid, starting with the NORTHERNMOST row that
    contains receptors that you wish to exclude, and finishing with
    row 1 to the SOUTH (no intervening rows may be skipped).  Within
    a row, each receptor position is assigned either a 0 or 1,
    starting with the westernmost receptor.
       0 = gridded receptor not processed
       1 = gridded receptor processed

    Repeated value notation may be used to select blocks of receptors:
       23*1, 15*0, 12*1

    Because all values are initially set to 1, any receptors north of
    the first row entered, or east of the last value provided in a row,
    remain ON.

    (NGXRECP) -- Default: 1


-------------------------------------------------------------------------------

INPUT GROUP: 2 -- Visibility Parameters (ASPEC = VISIB)
--------------

    Identify the Base Time Zone for the CALPUFF simulation
                             (BTZONE) -- No default   ! BTZONE = 5.0 !

    Particle growth curve f(RH) for hygroscopic species
                               (MFRH) -- Default: 2   ! MFRH   =  2  !
```

```
         1 =  IWAQM (1998) f(RH) curve (originally used with MVISBK=1)
         2 =  FLAG (2000) f(RH) tabulation
         3 =  EPA (2003) f(RH) tabulation

    Maximum relative humidity (%) used in particle growth curve
                              (RHMAX) -- Default: 98  ! RHMAX  = 98.0 !

    Modeled species to be included in computing the light extinction
     Include SULFATE?          (LVSO4) -- Default: T   ! LVSO4  = T  !
     Include NITRATE?          (LVNO3) -- Default: T   ! LVNO3  = T  !
     Include ORGANIC CARBON?   (LVOC)  -- Default: T   ! LVOC   = T  !
     Include COARSE PARTICLES? (LVPMC) -- Default: T   ! LVPMC  = T  !
     Include FINE PARTICLES?   (LVPMF) -- Default: T   ! LVPMF  = T  !
     Include ELEMENTAL CARBON? (LVEC)  -- Default: T   ! LVEC   = T  !

    And, when ranking for TOP-N, TOP-50, and Exceedance tables,
     Include BACKGROUND?       (LVBK)  -- Default: T   ! LVBK   = T  !

    Species name used for particulates in MODEL.DAT file
                   COARSE    (SPECPMC) -- Default: PMC ! SPECPMC = PMC !
                   FINE      (SPECPMF) -- Default: PMF ! SPECPMF = SOIL !

Extinction Efficiency (1/Mm per ug/m**3)
----------------------------------------
    MODELED particulate species:
               PM  COARSE      (EEPMC) -- Default: 0.6 ! EEPMC  = 0.6 !
               PM  FINE        (EEPMF) -- Default: 1.0 ! EEPMF  = 1.0 !
    BACKGROUND particulate species:
               PM  COARSE    (EEPMCBK) -- Default: 0.6 ! EEPMCBK = 0.6 !
    Other species:
              AMMONIUM SULFATE (EESO4) -- Default: 3.0 ! EESO4  = 3.0 !
              AMMONIUM NITRATE (EENO3) -- Default: 3.0 ! EENO3  = 3.0 !
              ORGANIC CARBON   (EEOC)  -- Default: 4.0 ! EEOC   = 4.0 !
              SOIL             (EESOIL)-- Default: 1.0 ! EESOIL = 1.0 !
              ELEMENTAL CARBON (EEEC)  -- Default: 10. ! EEEC   = 10.0 !

Background Extinction Computation
---------------------------------

    Method used for the 24h-average of percent change of light extinction:
    Hourly ratio of source light extinction / background light extinction
    is averaged?              (LAVER) -- Default: F   ! LAVER = F  !


    Method used for background light extinction
                             (MVISBK) -- Default: 2   ! MVISBK =  6  !

         1 =  Supply single light extinction and hygroscopic fraction
              - Hourly F(RH) adjustment applied to hygroscopic background
```

```
              and modeled sulfate and nitrate
        2 =  Compute extinction from speciated PM measurements (A)
             - Hourly F(RH) adjustment applied to observed and modeled sulfate
               and nitrate
             - F(RH) factor is capped at F(RHMAX)
        3 =  Compute extinction from speciated PM measurements (B)
             - Hourly F(RH) adjustment applied to observed and modeled sulfate
               and nitrate
             - Receptor-hour excluded if RH>RHMAX
             - Receptor-day excluded if fewer than 6 valid receptor-hours
        4 =  Read hourly transmissometer background extinction measurements
             - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
             - Hour excluded if measurement invalid (missing, interference,
               or large RH)
             - Receptor-hour excluded if RH>RHMAX
             - Receptor-day excluded if fewer than 6 valid receptor-hours
        5 =  Read hourly nephelometer background extinction measurements
             - Rayleigh extinction value (BEXTRAY) added to measurement
             - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
             - Hour excluded if measurement invalid (missing, interference,
               or large RH)
             - Receptor-hour excluded if RH>RHMAX
             - Receptor-day excluded if fewer than 6 valid receptor-hours
        6 =  Compute extinction from speciated PM measurements
             - FLAG monthly RH adjustment factor applied to observed and
               modeled sulfate and nitrate
        7 =  Use observed weather or prognostic weather information for
             background extinction during weather events; otherwise, use Method 2
             - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
             - F(RH) factor is capped at F(RHMAX)
             - During observed weather events, compute Bext from visual range
               if using an observed weather data file, or
             - During prognostic weather events, use Bext from the prognostic
               weather file
             - Use Method 2 for hours without a weather event

    Additional inputs used for MVISBK = 1:
    --------------------------------------
     Background light extinction (1/Mm)
                              (BEXTBK) -- No default   ! BEXTBK = 0.0 !
     Percentage of particles affected by relative humidity
                              (RHFRAC) -- No default   ! RHFRAC = 0.0 !

    Additional inputs used for MVISBK = 6:
    --------------------------------------
     Extinction coefficients for hygroscopic species (modeled and
     background) are computed using a monthly RH adjustment factor
     in place of an hourly RH factor (VISB.DAT file is NOT needed).
     Enter the 12 monthly factors here (RHFAC).  Month 1 is January.
```

```
 (RHFAC)  -- No default     ! RHFAC = 3.1, 2.8, 2.8, 2.5,
                                      3.1, 3.4, 3.5, 3.9,
                                      3.9, 3.2, 3.0, 3.1 !

Additional inputs used for MVISBK = 7:
--------------------------------------
 The weather data file (DATSAV abbreviated space-delimited) that
 is identified as VSRN.DAT may contain data for more than one
 station.  Identify the stations that are needed in the order in
 which they will be used to obtain valid weather and visual range.
 The first station that contains valid data for an hour will be
 used.  Enter up to MXWSTA (set in PARAMS file) integer station IDs
 of up to 6 digits each as variable IDWSTA, and enter the corresponding
 time zone for each, as variable TZONE (= UTC-LST).

 A prognostic weather data file with Bext for weather events may be used
 in place of the observed weather file.  Identify this as the VSRN.DAT
 file and use a station ID of IDWSTA = 999999, and TZONE = 0.

 NOTE:  TZONE identifies the time zone used in the dataset.  The
        DATSAV abbreviated space-delimited data usually are prepared
        with UTC time rather than local time, so TZONE is typically
        set to zero.

 (IDWSTA)   -- No default
! IDWSTA = 999999 !
 (TZONE)    -- No default
! TZONE  = 0.0 !

Additional inputs used for MVISBK = 2,3,6,7:
--------------------------------------------
 Background extinction coefficients are computed from monthly
 CONCENTRATIONS of ammonium sulfate (BKSO4), ammonium nitrate (BKNO3),
 coarse particulates (BKPMC), organic carbon (BKOC), soil (BKSOIL), and
 elemental carbon (BKEC).  Month 1 is January.
 (ug/m**3)

 (BKSO4)  -- No default     ! BKSO4 = 0.00, 0.00, 0.00, 0.00,
                                      0.00, 0.00, 0.00, 0.00,
                                      0.00, 0.00, 0.00, 0.00 !
 (BKNO3)  -- No default     ! BKNO3 = 0.00, 0.00, 0.00, 0.00,
                                      0.00, 0.00, 0.00, 0.00,
                                      0.00, 0.00, 0.00, 0.00 !
 (BKPMC)  -- No default     ! BKPMC = 0.00, 0.00, 0.00, 0.00,
                                      0.00, 0.00, 0.00, 0.00,
                                      0.00, 0.00, 0.00, 0.00 !
 (BKOC)   -- No default     ! BKOC  = 0.00, 0.00, 0.00, 0.00,
                                      0.00, 0.00, 0.00, 0.00,
```

```
                                        0.00, 0.00, 0.00, 0.00 !
     (BKSOIL) -- No default     ! BKSOIL= 10.98, 10.98, 10.98, 10.98,
                                        10.98, 10.98, 10.98, 10.98,
                                        10.98, 10.98, 10.98, 10.98 !
     (BKEC)   -- No default     ! BKEC  = 0.00, 0.00, 0.00, 0.00,
                                        0.00, 0.00, 0.00, 0.00,
                                        0.00, 0.00, 0.00, 0.00 !

    Additional inputs used for MVISBK = 2,3,5,6,7:
    ----------------------------------------------
     Extinction due to Rayleigh scattering is added (1/Mm)
                            (BEXTRAY) -- Default: 10.0 ! BEXTRAY = 10.0 !

!END!
-------------------------------------------------------------------------------

INPUT GROUP: 3 -- Output options
--------------

Documentation
-------------

    Documentation records contained in the header of the
    CALPUFF output file may be written to the list file.
    Print documentation image?
                                (LDOC) -- Default: F   !  LDOC = F !

Output Units
------------
    Units for All Output       (IPRTU) -- Default: 1   ! IPRTU =  3   !
                      for           for
                Concentration    Deposition
       1 =         g/m**3         g/m**2/s
       2 =        mg/m**3        mg/m**2/s
       3 =        ug/m**3        ug/m**2/s
       4 =        ng/m**3        ng/m**2/s
       5 =      Odour Units

    Visibility: extinction expressed in 1/Mega-meters (IPRTU is ignored)


Averaging time(s) reported
--------------------------

    1-hr averages           (L1HR) -- Default: T   !   L1HR = F  !

    3-hr averages           (L3HR) -- Default: T   !   L3HR = F  !

    24-hr averages         (L24HR) -- Default: T   !  L24HR = T  !
```

```
    Run-length averages    (LRUNL) -- Default: T   !  LRUNL = F  !

    User-specified averaging time in hours - results for
    an averaging time of NAVG hours are reported for
    NAVG greater than 0:
                           (NAVG) -- Default: 0   !   NAVG =  0  !


Types of tabulations reported
-----------------------------

   1) Visibility: daily visibility tabulations are always reported
                  for the selected receptors when ASPEC = VISIB.
                  In addition, any of the other tabulations listed
                  below may be chosen to characterize the light
                  extinction coefficients.
                  [List file or Plot/Analysis File]


   2) Top 50 table for each averaging time selected
      [List file only]
                           (LT50) -- Default: T   !   LT50 = F  !

   3) Top 'N' table for each averaging time selected
      [List file or Plot file]
                          (LTOPN) -- Default: F   !  LTOPN = T  !

        -- Number of 'Top-N' values at each receptor
           selected (NTOP must be <= 4)
                           (NTOP) -- Default: 4   ! NTOP =  1   !

        -- Specific ranks of 'Top-N' values reported
           (NTOP values must be entered)
                   (ITOP(4) array) -- Default:     ! ITOP =  1   !
                                      1,2,3,4


   4) Threshold exceedance counts for each receptor and each averaging
      time selected
      [List file or Plot file]
                          (LEXCD) -- Default: F   !  LEXCD = F  !

        -- Identify the threshold for each averaging time by assigning a
           non-negative value (output units).

                                   -- Default: -1.0
           Threshold for  1-hr averages   (THRESH1) !  THRESH1 = -1.0  !
           Threshold for  3-hr averages   (THRESH3) !  THRESH3 = -1.0  !
```

```
           Threshold for 24-hr averages  (THRESH24) ! THRESH24 = -1.0  !
           Threshold for NAVG-hr averages (THRESHN) !  THRESHN = -1.0  !


         -- Counts for the shortest averaging period selected can be
            tallied daily, and receptors that experience more than NCOUNT
            counts over any NDAY period will be reported.  This type of
            exceedance violation output is triggered only if NDAY > 0.

            Accumulation period(Days)
                            (NDAY) -- Default: 0   !    NDAY =  0  !
            Number of exceedances allowed
                          (NCOUNT) -- Default: 1   !  NCOUNT =  1  !


   5) Selected day table(s)

      Echo Option -- Many records are written each averaging period
      selected and output is grouped by day
      [List file or Plot file]
                           (LECHO) -- Default: F   !  LECHO = F  !

      Timeseries Option -- Averages at all selected receptors for
      each selected averaging period are written to timeseries files.
      Each file contains one averaging period, and all receptors are
      written to a single record each averaging time.
      [TSERIES_ASPEC_ttHR_CONC TSUNAM.DAT files]
                           (LTIME) -- Default: F   !  LTIME = F  !

      Peak Value Option -- Averages at all selected receptors for
      each selected averaging period are screened and the peak value
      each period is written to timeseries files.
      Each file contains one averaging period.
      [PEAKVAL_ASPEC_ttHR_CONC TSUNAM.DAT files]
                           (LPEAK) -- Default: F   !  LPEAK = F  !

        -- Days selected for output
                       (IECHO(366)) -- Default: 366*0
           ! IECHO  = 366*0  !
           (366 values must be entered)

Plot output options
-------------------

     Plot files can be created for the Top-N, Exceedance, and Echo
     tables selected above.  Two formats for these files are available,
     DATA and GRID.  In the DATA format, results at all receptors are
     listed along with the receptor location [x,y,val1,val2,...].
     In the GRID format, results at only gridded receptors are written,
```

```
     using a compact representation.  The gridded values are written in
     rows (x varies), starting with the most southern row of the grid.
     The GRID format is given the .GRD extension, and includes headers
     compatible with the SURFER(R) plotting software.

     A plotting and analysis file can also be created for the daily
     peak visibility summary output, in DATA format only.

     Generate Plot file output in addition to writing tables
     to List file?
                               (LPLT) -- Default: F   ! LPLT  = F !

     Use GRID format rather than DATA format,
     when available?
                               (LGRD) -- Default: F   ! LGRD  = F !


Auxiliary Output Files (for subsequent analyses)
------------------------------------------------

      Visibility

      A separate output file may be requested that contains the change
      in visibility at each selected receptor when ASPEC = VISIB.  This
      file can be processed to construct visibility measures that are
      not available in CALPOST.

      Output file with the visibility change at each receptor?
                              (MDVIS) -- Default: 0   ! MDVIS  =  1  !

           0 =  Do Not create file
           1 =  Create file of DAILY (24 hour) Delta-Deciview
           2 =  Create file of DAILY (24 hour) Extinction Change (%)
           3 =  Create file of HOURLY Delta-Deciview
           4 =  Create file of HOURLY Extinction Change (%)


Additional Debug Output
-----------------------

   Output selected information to List file
    for debugging?
                             (LDEBUG) -- Default: F  ! LDEBUG  = F !

   Output hourly extinction information to REPORT.HRV?
    (Visibility Method 7)
                            (LVEXTHR) -- Default: F  ! LVEXTHR = F !

!END!
```

APPENDIX B

COMPARATIVE ANALYSIS FOR EXPLICIT CALPUFF MODELING

Sample model processing files provided by the VISTAS Technical Contractor demonstrate modeling of a single point source using CALPUFF, POSTUTIL, and CALPOST to assess visibility change.[18] The sample approach simulates actual emissions of each of three gaseous pollutants (SO_2, SO_4, and NO_X) and unit emissions (e.g., 1 g/s) of each of six generic particle categories distinguished and designated by size: PM800, PM425, PM187, PM112, PM081, and PM056, to represent $PM_{6\text{-}10}$, $PM_{2.5\text{-}6}$, $PM_{1.25\text{-}2.5}$, $PM_{1\text{-}1.25}$, $PM_{0.625}$-$_1$, and $PM_{0.5\text{-}0.625}$, respectively. Because unit emission rates were modeled from the single point source in the sample approach, actual emission rates were used in the POSTUTIL postprocessing step to combine PM types and sizes into light scattering groups by scaling the modeled concentrations up or down by the multiplicative factor of the actual emission rate of each PM size category, which includes multiple types of PM (e.g., coarse filterable PM, fine filterable PM, organic condensable PM, inorganic condensable PM, and elemental carbon). The output concentration file from POSTUTIL was then input to CALPOST to calculate visibility change attributable to emissions from the point source in the sample analysis.

The preceding approach is reasonable for modeling a single point source; however, for facilities with multiple emission point sources, the preceding approach is not appropriate. Specifically, for sources with multiple emission points that have different exhaust characteristics (e.g., stack height, diameter, velocity, and temperature) and/or different emissions profiles of speciated PM, the use of unit emission rates is not appropriate since the CALPUFF output concentrations at particular receptors will not distinguish which source(s) contribute to the PM concentrations. Therefore, the POSTUTIL source profile technique cannot be applied. One alternative to this approach for sources with multiple emission points is to model each emission point individually in multiple CALPUFF runs using unit emission rates, then run POSTUTIL to assign the PM concentrations at each receptor for each modeled emission point to each species, finally running the CALSUM postprocessing utility to combine the impacts of all sources. This approach, though conceptually appropriate, is undesirable due to substantial additional computer runtime required to model and post-process each emission point individually.

As a computationally efficient alternative to the preceding approaches, the BART Applicability Analysis for Honeywell's Hopewell Plant was conducted by explicitly modeling in CALPUFF the actual emission rate of each of 14 particle species defined as described in Table B-1. The nomenclature used in Table B-1 is analogous to that used to describe the emissions from Honeywell's BART-eligible emission units in Section 2 of this report.

[18] http://www.src.com/verio/download/sample_files.htm#EXAMPLE_BART

TABLE B-1. EXPLICIT MODELING OF PM TYPES AND SIZE CATEGORIES

Modeled PM Category	Components
PMC800 PMC425	Filterable coarse particles divided between two size categories (PM_{6-10}, $PM_{2.5-6}$)
PMF187 PMF112 PMF081 PMF056	Filterable fine particles divided among four size categories ($PM_{1.25-2.5}$, $PM_{1-1.25}$, $PM_{0.625-1}$, $PM_{0.5-0.625}$)
POC081 POC056	Primary condensable organic emissions divided between two size categories ($PM_{0.625-1}$ and $PM_{0.5-0.625}$)
PIC081 PIC056	Primary condensable inorganic emissions divided between two size categories ($PM_{0.625-1}$ and $PM_{0.5-0.625}$)
EC187 EC112 EC081 EC056	Primary elemental carbon emissions divided among four size categories ($PM_{1.25-2.5}$, $PM_{1-1.25}$, $PM_{0.625-1}$, $PM_{0.5-0.625}$)

So that explicit modeling of the 14 particle species and sizes could be conducted equivalently to the unit emissions approach, identical model processing options for each PM size category were enabled as summarized in Table B-2.

TABLE B-2. REPRESENTATION OF EXPLICITLY MODELED PM SIZE CATEGORIES IN CALPUFF

Model Species	Computed Deposition Mode	Geometric Mass Mean Diameter (microns)	Geometric Standard Deviation (microns)*	Precipitation Scavenging Coefficient Liquid (s^{-1})	Precipitation Scavenging Coefficient Frozen (s^{-1})
PMC800	Particle	8.0	0	1.0×10^{-4}	3.0×10^{-5}
PMC425	Particle	4.25	0	1.0×10^{-4}	3.0×10^{-5}
PMF187 EC187	Particle	1.87	0	1.0×10^{-4}	3.0×10^{-5}
PMF112 EC112	Particle	1.12	0	1.0×10^{-4}	3.0×10^{-5}
PMF081 EC081 POC081 PIC081	Particle	0.81	0	1.0×10^{-4}	3.0×10^{-5}
PMF056 EC056 POC056 PIC056	Particle	0.56	0	1.0×10^{-4}	3.0×10^{-5}

* Zero geometric standard deviation indicates that CALPUFF utilizes the deposition velocity associated with the geometric mass mean diameter.

To post-process the CALPUFF output concentrations that result from explicitly modeled multiple emission points, POSTUTIL was used only to group modeled PM into light extinction groups. Unit scaling factors were used in POSTUTIL and there was no adjustment to the explicitly modeled emission rate. Table B-3 summarizes the POSTUTIL grouping of modeled PM species into light extinction groups, and the light extinction coefficient subsequently used in CALPOST to compute light extinction due to the multiple emission points at the source.

TABLE B-3. ASSIGNMENT OF MODELED PM SPECIES TO LIGHT EXTINCTION GROUPS

Modeled Components	CALPOST Light Extinction Group	Extinction Coefficient (m^2/g)
PMC800 PMC425	PMC	0.6
PMF187 PMF112 PMF081 PMF056 PIC081 PIC056	SOIL	1
POC081 POC056	SOA	4
EC187 EC112 EC081 EC056	EC	10

Explicit modeling of the 14 PM types and sizes plus the SO_2, SO_4, NO_X, HNO_3, NO_3, and NH_3 species results in a total of 20 modeled species, which is within the default parameter limit of 20 species modeled (MXSPEC). As envisioned in Honeywell's initial source-specific modeling protocol, previous versions of CALPUFF (i.e., version 5.754), would have required a modification to the FORTRAN compilation; however, in the current version of CALPUFF (i.e., Version 5.756) the parameter for particle species deposited (MXPDEP) was increased from 9 to 20 to accommodate the greater number (16, including SO_4 and NO_3) of particle species simulated in the model.[19]

This modified approach follows conceptually the steps outlined in the revised *VISTAS BART Modeling Protocol* as evidenced between comparisons between the two methods. Results using the explicit method for multiple emission points and the sample method using a single point source with PM speciation (PMF, PMC, SOA, EC) applied during the POSTUTIL step provides equivalent results. The following example model input and output files of a comparative analysis are presented to illustrate this approach. The comparative analysis was performed using emissions from a representative example BART-eligible facility located in South Carolina using the screening approach for the data year 2002 to compute visibility impacts at the Cape Romain NWR Class I area using the annual average natural background conditions.

[19] http://src.com/verio/download/vistas_codes.htm

To demonstrate the equivalent performance of both models, the following four example point sources listed in Table B-4 were modeled.

TABLE B-4. COMPARATIVE ANALYSIS EMISSIONS SOURCES

Modeled PM Category	Emission Rates (g/s) Source 1	Source 2	Source 3	Source 4
PMC800	1.20×10^{-3}	1.20×10^{-1}	4.10×10^{-2}	4.10×10^{-2}
PMC425	2.50×10^{-2}	3.70×10^{-1}	2.60×10^{-1}	2.60×10^{-1}
PMF187	1.30×10^{-1}	3.40×10^{-1}	6.60×10^{-1}	6.60×10^{-1}
PMF112	7.00×10^{-2}	1.60×10^{-1}	3.30×10^{-1}	3.30×10^{-1}
PMF081	2.80×10^{-1}	3.10×10^{-1}	5.90×10^{-1}	5.90×10^{-1}
PMF056	6.20×10^{-1}	5.60×10^{-1}	1.40	1.40
POC081	1.80×10^{-3}	8.40×10^{-1}	5.60×10^{-2}	5.60×10^{-2}
POC056	1.80×10^{-3}	8.40×10^{-1}	5.60×10^{-2}	5.60×10^{-2}
PIC081	3.60×10^{-2}	7.70	2.50×10^{-1}	2.50×10^{-1}
PIC056	3.60×10^{-2}	7.70	2.50×10^{-1}	2.50×10^{-1}
EC187	--	--	--	--
EC112	--	--	--	--
EC081	--	--	--	--
EC056	--	--	--	--

The emissions rates listed in Table B-4 for all sources were modeled explicitly using Trinity's modified CALPUFF executable. Using the VISTAS Sample approach, unit PM emission rates were modeled for each individual source in a separate CALPUFF run and the scaling factors listed in Table B-5 were applied in POSTUTIL. Note that as described in Table B-3, emission rates for PMF and PIC are combined in this approach.

TABLE B-5. VISTAS SAMPLE ANALYSIS POSTUITL SCALING FACTORS

Modeled PM Category	Emission Rates (g/s) Source 1	Source 2	Source 3	Source 4
CSPECCMP = EC				
PM187	0.00000	0.00000	0.00000	0.00000
PM112	0.00000	0.00000	0.00000	0.00000
PM081	0.00000	0.00000	0.00000	0.00000
PM056	0.00000	0.00000	0.00000	0.00000
CSPECCMP = SOIL				
PM187	0.13000	0.34000	0.66000	0.66000
PM112	0.07000	0.16000	0.33000	0.33000
PM081	0.31600	8.01000	0.84000	0.84000
PM056	0.65600	8.26000	1.65000	1.65000
CSPECCMP = SOA				
PM081	0.00180	0.84000	0.05600	0.05600
PM056	0.00180	0.84000	0.05600	0.05600
CSPECCMP = PMC				
PM800	0.00120	0.12000	0.04100	0.04100
PM425	0.02500	0.37000	0.26000	0.26000

VISTAS SAMPLE ANALYSES

1. MS-DOS BATCH RUN FILE **RUNCPUFF1.BAT**
   This MS-DOS batch file sequentially runs the following analyses to simulate unit PM emissions from four sources independently, apply the actual emission rates using POSTUTIL, combine the files using the CALSUM utility to add the concentrations at each receptor due to each source, then finally run CALPOST to calculate the visibility impact.

2. CALPUFF INPUT FILE SOURCE "A" **VISTAS02A.INP**
3. CALPUFF INPUT FILE SOURCE "B" **VISTAS02B.INP**
4. CALPUFF INPUT FILE SOURCE "C" **VISTAS02C.INP**
5. CALPUFF INPUT FILE SOURCE "D" **VISTAS02D.INP**
   These CALPUFF input files were used to run the model for each source individually, with all PM emission rates modeled as 1.0 g/s. A total of 11 species are modeled. The standard CALPUFFL.EXE CALPUFF executable file obtained from the VISTAS Technical Contractor was used to perform the analysis. The output of the CALPUFF runs "VISTAS02*x*.CON" are the concentration files that are input to POSTUTIL in the next step.

6. POSTUTIL INPUT FILE SOURCE "A" **VISTASUT02A.INP**
7. POSTUTIL INPUT FILE SOURCE "B" **VISTASUT02B.INP**
8. POSTUTIL INPUT FILE SOURCE "C" **VISTASUT02C.INP**
9. POSTUTIL INPUT FILE SOURCE "D" **VISTASUT02D.INP**
   The POSTUTIL input files were used to scale the PM concentrations modeled in CALPUFF by the actual emission rates of each PM species. The sum of PM species factors applied in POSTUTIL equals the total PM emission rate for the source (less contribution from primary sulfate emissions), and the speciated factors represent those tabulated for each source in Section 2 of this report. Note that scaling of "SOIL" concentrations include contributions from emissions quantified as PIC and PMF as illustrated in Table C-3. A total of 9 species are output from POSTUTIL, including the computed species (EC, SOIL, SOA, PMC) integrated over the size categories in addition to the explicitly modeled species (SO2, SO4, NOX, HNO3, NO3). The output of the POSTUTIL runs "VISTASUT02*x*.CON" are the grouped and scaled concentration files input to CALSUM in the next step.

10. CALSUM INPUT FILE **VISTASSUM02.INP**
    This CALSUM input file, after being copied into the appropriate file name "CALSUM.INP" for compatibility with the CALSUM.exe runstream, adds the scaled concentrations of the 9 output species from POSTUTIL for each receptor and averaging period. The output of CALSUM in "VISTASUT02.CON", which is subsequently passed to CALPOST.

11. CALPOST INPUT FILE **VISTASVANCR02.INP**
    This CALPOST file calculates the visibility impacts due to concentrations reported in "VISTASUT02.CON" for the receptors representing Cape Romain using the annual average natural background conditions. The results of the analysis are written to the file "VISTASVANCR02.LST".

TRINITY'S EXPLICIT ANALYSES

1. MS-DOS BATCH RUN FILE **RUNCPUFF2.BAT**
   This MS-DOS batch file sequentially runs the following analyses to simulate actual emissions from four sources modeled in one CALPUFF run, combine the speciated PM size groups into output species using POSTUTIL, then finally run CALPOST to calculate the visibility impact.

2. CALPUFF INPUT FILE ALL SOURCES **EXPLICIT02.INP**
   This CALPUFF input file was used to run the model for all sources using actual PM emission rates speciated for type (e.g., PIC, PMF) and size distribution. A total of 19 species are modeled, including speciated size categories of all PM. The sum of PM species emission rates equals the total PM emission rate for the source (less contribution from primary sulfate emissions), and the speciated factors represent those tabulated for each source in Section 2 of this report. The output of the CALPUFF runs "EXPLICIT02.CON" is the concentration files that are input to POSTUTIL in the next step.

3. POSTUTIL INPUT FILE ALL SOURCES **EXPLICITUT02.INP**
   The POSTUTIL input file was used only to combine, not scale, the PM concentrations modeled in CALPUFF. A total of 9 species are output from POSTUTIL, including the computed species (EC, SOIL, SOA, PMC) integrated over the size categories in addition to the explicitly modeled species (SO2, SO4, NOX, HNO3, NO3). The output of the POSTUTIL runs "EXPLICITUT02.CON" are the grouped concentration files input to CALSUM in the next step.

4. CALPOST INPUT FILE **EXPLICITVANCR02.INP**
   This CALPOST file calculates the visibility impacts due to concentrations reported in "EXPLICITUT02.CON" for the receptors representing Cape Romain using the annual average natural background conditions. The results of the analysis are written to the file "EXPLICITVANCR02.LST".

COMPARATIVE ANALYSIS OUTPUT FILES

The output files from the VISTAS Sample and Trinity's Explicit analyses follow and indicate equivalent results. The primary benefit of this approach is time savings from running CALPUFF and subsequent postprocessors once (albeit for a greater number of sources) than one time for each source. Table B-6 compares computer runtime for these methods on Pentium-4 class desktop computers. The differences in computer processing runtime are appreciable when integrated over numerous runs for facilities with multiple emissions sources.

TABLE B-6. COMPARISON OF COMPUTER RUNTIME USING SAMPLE AND EXPLICIT APPROACHES

Processing Step	VISTAS Sample Analysis Runtime (minutes)	Trinity's Explicit Analysis Runtime (minutes)
CALPUFF	170	105
POSTUTIL	2	< 1
CALSUM	< 1	--
CALPOST	< 1	< 1
Total Time	**2 hours, 54 minutes**	**1 hour, 47 minutes**

The computer modeling executable, input, and output files for the comparative analysis are provided for review on the electronic media included with this BART Applicability Analysis report. Each analysis is contained within a separate folder (i.e., "VISTAS" and "EXPLICIT", respectively) which includes the CALPUFF model executable file.

VISTAS SAMPLE (UNIT PM EMISSIONS) MODEL PROCESSING RESULTS (VISTASVANCR02.LST)

--- Ranked Daily Visibility Change ---

										% of Modeled Extinction by Species					
YEAR	DAY	HR	RECEPTOR	COORDINATES (km)		TYPE	DV(Total)	DV(BKG)	DELTA DV	F(RH)	%_SO4	%_NO3	%_OC	%_EC	%_PMC	%_PMF	
2002	185	0	17	1612.857	-628.331	D	8.793	7.519	1.274	3.600	84.03	0.63	3.34	0.00	0.32	11.67	1
2002	272	0	1	1609.918	-633.619	D	8.780	7.519	1.261	4.000	85.63	2.44	2.72	0.00	0.24	8.98	2
2002	294	0	95	1618.776	-613.968	D	8.716	7.519	1.197	3.700	84.63	2.21	2.86	0.00	0.26	10.05	3
2002	219	0	25	1610.626	-624.988	D	8.642	7.519	1.123	4.100	89.60	0.36	2.27	0.00	0.19	7.58	4
2002	169	0	1	1609.918	-633.619	D	8.556	7.519	1.037	3.700	82.10	0.35	3.79	0.00	0.37	13.39	5
2002	186	0	32	1611.037	-623.021	D	8.550	7.519	1.032	3.600	76.89	0.72	4.03	0.00	0.60	17.75	6
2002	309	0	1	1609.918	-633.619	D	8.395	7.519	0.877	3.400	78.76	6.81	3.23	0.00	0.26	10.95	7
2002	77	0	34	1612.386	-621.816	D	8.385	7.519	0.867	2.900	64.49	6.21	5.30	0.00	0.75	23.26	8
2002	233	0	7	1610.154	-630.742	D	8.373	7.519	0.854	4.100	76.21	1.67	4.29	0.00	0.55	17.28	9
2002	232	0	1	1609.918	-633.619	D	8.359	7.519	0.840	4.100	74.72	0.42	5.61	0.00	0.50	18.75	10
2002	30	0	18	1610.390	-627.865	D	8.350	7.519	0.831	3.300	57.97	11.11	5.48	0.00	0.82	24.63	11
2002	322	0	14	1610.566	-628.774	D	8.306	7.519	0.787	3.400	42.55	7.44	9.70	0.00	1.19	39.11	12
2002	236	0	37	1612.973	-620.758	D	8.251	7.519	0.732	4.100	81.74	0.37	4.21	0.00	0.33	13.36	13
2002	280	0	1	1609.918	-633.619	D	8.226	7.519	0.708	3.700	80.24	6.72	2.67	0.00	0.30	10.06	14
2002	146	0	65	1615.318	-616.528	D	8.219	7.519	0.700	3.200	79.12	2.00	4.35	0.00	0.36	14.17	15
2002	78	0	48	1633.970	-614.771	D	8.194	7.519	0.675	2.900	87.87	3.39	2.22	0.00	0.12	6.40	16
2002	18	0	3	1610.506	-632.561	D	8.183	7.519	0.664	3.300	60.46	8.98	6.87	0.00	0.61	23.08	17
2002	187	0	2	1610.682	-633.471	D	8.176	7.519	0.657	3.600	79.41	0.71	4.73	0.00	0.36	14.78	18
2002	351	0	1	1609.918	-633.619	D	8.111	7.519	0.592	3.200	31.24	7.10	12.07	0.00	1.38	48.22	19
2002	48	0	1	1609.918	-633.619	D	8.107	7.519	0.589	3.000	52.95	19.14	5.48	0.00	0.65	21.78	20
2002	153	0	11	1610.742	-629.684	D	8.051	7.519	0.532	3.700	76.87	0.59	5.24	0.00	0.43	16.87	21
2002	277	0	2	1610.682	-633.471	D	8.041	7.519	0.522	3.700	87.31	1.31	2.15	0.00	0.26	8.97	22

--- Number of days with Delta-Deciview => 0.50: 24
--- Number of days with Delta-Deciview => 1.00: 6
--- Largest Delta-Deciview = 1.274

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CALPOST Version 5.6393 Level 060202

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TRINITY'S EXPLICIT MODEL PROCESSING RESULTS (EXPLICITVANCR02.LST)

--- Ranked Daily Visibility Change ---

										% of Modeled Extinction by Species					
YEAR	DAY	HR	RECEPTOR	COORDINATES (km)		TYPE	DV(Total)	DV(BKG)	DELTA DV	F(RH)	%_SO4	%_NO3	%_OC	%_EC	%_PMC	%_PMF	
2002	185	0	17	1612.857	-628.331	D	8.793	7.519	1.274	3.600	84.03	0.63	3.34	0.00	0.32	11.67	1
2002	272	0	1	1609.918	-633.619	D	8.780	7.519	1.261	4.000	85.63	2.44	2.72	0.00	0.24	8.98	2
2002	294	0	95	1618.776	-613.968	D	8.716	7.519	1.197	3.700	84.63	2.21	2.86	0.00	0.26	10.05	3
2002	219	0	25	1610.626	-624.988	D	8.642	7.519	1.123	4.100	89.60	0.36	2.27	0.00	0.19	7.58	4
2002	169	0	1	1609.918	-633.619	D	8.556	7.519	1.037	3.700	82.10	0.35	3.79	0.00	0.37	13.39	5
2002	186	0	32	1611.037	-623.021	D	8.550	7.519	1.032	3.600	76.89	0.72	4.03	0.00	0.60	17.75	6
2002	309	0	1	1609.918	-633.619	D	8.395	7.519	0.877	3.400	78.76	6.80	3.23	0.00	0.26	10.95	7
2002	77	0	34	1612.386	-621.816	D	8.385	7.519	0.867	2.900	64.49	6.21	5.30	0.00	0.75	23.26	8
2002	233	0	7	1610.154	-630.742	D	8.373	7.519	0.854	4.100	76.21	1.67	4.29	0.00	0.55	17.28	9
2002	232	0	1	1609.918	-633.619	D	8.359	7.519	0.840	4.100	74.72	0.42	5.61	0.00	0.50	18.75	10
2002	30	0	18	1610.390	-627.865	D	8.350	7.519	0.831	3.300	57.97	11.11	5.48	0.00	0.82	24.63	11
2002	322	0	14	1610.566	-628.774	D	8.306	7.519	0.787	3.400	42.55	7.44	9.70	0.00	1.19	39.11	12
2002	236	0	37	1612.973	-620.758	D	8.251	7.519	0.732	4.100	81.73	0.37	4.21	0.00	0.33	13.36	13
2002	280	0	1	1609.918	-633.619	D	8.226	7.519	0.708	3.700	80.25	6.72	2.67	0.00	0.30	10.06	14
2002	146	0	65	1615.318	-616.528	D	8.219	7.519	0.700	3.200	79.12	2.00	4.35	0.00	0.36	14.17	15
2002	78	0	48	1633.970	-614.771	D	8.194	7.519	0.675	2.900	87.87	3.39	2.22	0.00	0.12	6.39	16
2002	18	0	3	1610.506	-632.561	D	8.183	7.519	0.665	3.300	60.46	8.97	6.87	0.00	0.61	23.08	17
2002	187	0	2	1610.682	-633.471	D	8.176	7.519	0.657	3.600	79.41	0.71	4.73	0.00	0.36	14.78	18
2002	351	0	1	1609.918	-633.619	D	8.111	7.519	0.592	3.200	31.24	7.10	12.07	0.00	1.38	48.22	19
2002	48	0	1	1609.918	-633.619	D	8.108	7.519	0.589	3.000	52.96	19.14	5.48	0.00	0.65	21.77	20
2002	153	0	11	1610.742	-629.684	D	8.051	7.519	0.532	3.700	76.87	0.59	5.24	0.00	0.43	16.87	21
2002	277	0	2	1610.682	-633.471	D	8.041	7.519	0.522	3.700	87.31	1.31	2.15	0.00	0.26	8.97	22

--- Number of days with Delta-Deciview => 0.50: 24
--- Number of days with Delta-Deciview => 1.00: 6
--- Largest Delta-Deciview = 1.274

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CALPOST Version 5.6393 Level 060202

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APPENDIX C

ELECTRONIC MEDIA DATA FILE INDEX

Electronic media enclosed with this report contain the input and output files from all CALPUFF, POSUTIL, and CALPOST processing for the screening and refined analyses, as well as the comparative analyses presented in Appendix B. Each analysis is contained within its own appropriately name compressed file, which includes model executable files and batch files to manage the runstream. A consistent file naming convention is used throughout, with the following general structure. All filenames contain the HONYWLVA root to denote Honeywell – Hopewell, Virginia. Note that screening and refined meteorological data files are not provided due to file size. Note also that path names in input files will need to be modified to represent the user's directory structure when replicating these analyses.

CALPUFF Runstream Files

HONYWLVA*yy.fff*
yy = **01**, **02**, and **03** denotes data analysis years 2001, 2002, and 2003, respectively
fff = **inp** denotes input files
fff = **lst** denotes CALPUFF output summary files
fff = **con** denotes CALPUFF output concentration files

Ozone Data Files

OZONEX*yy.dat*
yy = **01**, **02**, and **03** denotes data analysis years 2001, 2002, and 2003, respectively

Screening Analyses POSTUTIL Processing Files

HONYWLVAUT*yy.fff*
yy = **01**, **02**, and **03** denotes data analysis years 2001, 2002, and 2003, respectively
fff = **inp** denotes input files
fff = **lst** denotes POSTUTIL output summary files
fff = **con** denotes POSTUTIL output concentration files

Refined Analysis POSTUTIL Processing Files

Note that in refined analyses, for which the ammonia limiting method was run, POSTUTIL is run in two separate steps, the first of which calculates the HNO3/NO3 re-partitioning, the second of which groups PM species for analysis in CALPOST. The first step (S1) is run in three, 4-month blocks (A, B, C) due to an inherent limitation in the number of meteorological periods that can be processed. Therefore, the APPEND utility must be run to concatenate the output files comprising these three blocks of data. CALPOST is subsequently run using this appended file.

HONYWLVAUT*yyb.fff*
yy = **01**, **02**, and **03** denotes data analysis years 2001, 2002, and 2003, respectively
b = **A**, **B**, and **C** denoting 4-month blocks January-April, May-August, September-December
fff = **inp** denotes input files
fff = **lst** denotes POSTUTIL output summary files
fff = **con** denotes POSTUTIL output concentration files

APPEND*yy.fff*
yy = **01**, **02**, and **03** denotes data analysis years 2001, 2002, and 2003, respectively
fff = **inp** denotes input files
fff = **lst** denotes POSTUTIL output summary files
EXAMPLE*yy*S1.con = POSTUTIL-ALM Step 1 concentration file for year *yy*.

HONYWLVAUT*yy.fff*
yy = **01**, **02**, and **03** denotes data analysis years 2001, 2002, and 2003, respectively
fff = **inp** denotes input files
fff = **lst** denotes POSTUTIL output summary files
fff = **con** denotes POSTUTIL output concentration files

CALPOST Runstream Files

HONYWLVA*mmmaayy.fff*
yy = **01**, **02**, and **03** denotes data analysis years 2001, 2002, and 2003, respectively
fff = **inp** denotes input files
fff = **lst** denotes CALPOST output summary files
fff = **del** denotes CALPOST auxiliary "DELVIS.DAT" visibility change output files

mmm denotes the following natural background conditions:
VAN = Annual Average using VISTAS approach of representing the natural background as SOIL concentration (Option 1)

aa denotes the Class I areas considered in the analyses:
SH = Shenandoah National Park
JR = James River Face Wilderness Area
SQ = Swanquarter National Wildlife Refuge
DS = Dolly Sods Wilderness Area
OC = Otter Creek Wilderness Area